

Comprehensive Assessment of North American Air Emissions Inventories and Ambient Air Monitoring Networks

Executive summary

The Comprehensive Assessment of North American Air Emissions Inventories and Ambient Air Monitoring Networks has four overarching objectives.

- First, the assessment seeks to establish how:
 - comparable inventory and monitoring methodologies are across the three countries; and
 - comparable and accessible inventory and monitoring databases are.
- Second, the assessment aims to establish how well existing inventories and networks in Canada, Mexico, and the United States are able to:
 - support analytical tools for addressing high priority national, cross-border, and North American air quality human health and environmental issues;
 - support multi-pollutant management strategies that deal with several high priority issues at once; and
 - inform deliberations about the connections between climate change, global air quality concerns (e.g., long-range transport of mercury, acids and ozone), and air quality across North America, and the implications for air quality management strategies in North America.
- Third, the assessment seeks to identify:
 - existing and/or planned infrastructures that could be used to help improve information content, comparability, and accessibility across countries; and
 - existing levels of capacity building that are needed to achieve more comparability and accessibility across countries.
- Fourth, the assessment sets out to recommend trilateral, short- and long-term strategies for improving the adequacy, comparability, and use of emissions and monitoring information by a broad audience including researchers, analysts, decision makers, and the general public, primarily in all three countries.

The scope of issues taken into account by the assessment is broad: human health and welfare in highly populated areas, some of which are considered mega cities; visibility degradation and ecosystem damages in rural and remote, as well as urban, regions; and contamination of water

bodies, wildlife and fish because of deposition of harmful toxics, which in turn adversely affect human health. The adequacy of existing air emission inventories and ambient air quality monitoring network databases to address these concerns in light of changes in emission sources and patterns, particularly those directly related to trade (e.g., transportation corridors and environmentally hazardous imports) is also taken into account. The assessment goes beyond how well these databases can be used to deal with individual issues, to cover how well the databases are positioned to assist in dealing with the interconnectedness of air quality issues, since effective management of multiple concerns can be greatly enhanced by multi-pollutant strategies. Finally, the assessment also considers emissions and the ability of monitoring information to address the chemical connections between greenhouse gases (GHG), criteria air pollutants (CAP), and toxics that influence the effectiveness of air quality management strategies. The assessment explores comprehensiveness, effectiveness, compatibility, and accessibility of information for addressing long-range transport of pollutants across countries (e.g., how US air quality affects that of both Mexico and Canada and is affected by each), particularly problematic US-Mexico and Canada-US border concerns, and national priorities. The assessment also points out key data gaps and research needs, infrastructure for improving the databases, capacity building opportunities for achieving improvements, and resource leveraging opportunities within and across countries. Based on this assessment of needs and opportunities, a set of recommendations is developed.

The assessment has benefited from a variety of reviews, interviews, analyses, and group discussions and workshops. Reports, write-ups and databases, many of which are publicly accessible from the web, have been reviewed. Interviews with experts and managers of emissions inventory and monitoring network programs have provided additional insights on the ongoing and planned processes and analyses. Reviews of the background report, the foundation of the assessment, provided by technical and policy experts have strengthened the assessment's coverage and accuracy. In-depth discussions about the assessment goals, guiding principals, and key steps at the fall workshop of experts from all three countries have provided a more meaningful framework for the assessment.

The assessment document is organized as follows:

- Detailed emission inventory and monitoring network database descriptions by country including database objectives, characteristics, and accessibility with emissions being presented first and monitoring second;
- Intercomparison and evaluation of databases—outlining high priority improvements needed to better deal with full scope of concerns being addressed in the assessment; noting those that are common for all three countries and those that are high priority individually; and discussing compatibility and accessibility of the databases and opportunities, including capacity building and resource leveraging, for improving these; and

Recommendations for addressing these high priority improvements—highlighting opportunities for database development and improvement through appropriate trilateral activities and developing suggested approaches to implementing these strategies.

Assessment of the databases shows that emission inventories for all three countries can be used to address urban air quality assessments. The emission inventories in the US and Canada are comprehensive enough to be used to address explicitly urban and regional air quality, border, and long-range transport human health and environmental well-being issues. The greenhouse gas national total emissions inventories for all three countries, developed under the United Nations Framework Convention on Climate Change (UNFCCC) guidelines, can be directly compared and used for analyses at the national total levels.

Review of monitoring networks shows that monitoring of basic urban air quality is reasonably complete for gases across the three countries. Coverage for particulate matter less than 2.5 microns ($PM_{2.5}$), however, is very limited for Mexico. There are no $PM_{2.5}$ speciation or volatile organic compound (VOC) speciation networks in Mexico. Monitoring outside of the urban areas for $PM_{2.5}$, ozone, species deposition (acid, nitrogen, and mercury), along with visibility, is covered in the United States and Canada but not in Mexico. There is reasonable coverage for toxics monitoring in Canada and the United States, but there is a limited number of air toxic networks in Mexico. Greenhouse gases are monitored at background sites in the United States and Canada.

US and Canadian databases are comprehensive enough to support management of many multiple pollutant issues and Mexico is working toward this goal, although additional resources will be needed. Developing formal, multi-pollutant management strategies, including comprehensive air quality modeling, that deal with North America as a whole will require careful integration of national inventories and reconciliation and expansion of monitoring systems. Databases are already reasonably in place to begin developing modeling and management structures to simultaneously address issues associated with CAPs and hazardous air pollutants (HAP). Comanagement of GHG issues with CAPs and HAPs concerns will require more effort: current GHG inventories at the national level are "top-down" and national averages are not easily integrated with spatially refined gridded inventories for other key air pollutants; plus GHG monitoring will need to be enhanced, particularly for Mexico.

In order to be able to explore, in depth, the connections between air quality and climate change, it will be important to have more complete and highly resolved inventories for the GHGs. In particular, area sources (e.g., agriculture, landfills) that are not adequately taken into account or spatially disaggregated in the inventories limit efforts to explore these links and need to be better addressed. Of special note are the emissions of CH_4 (methane) which influence ozone and fine particle chemistry regionally. At this point, the only official GHG inventories for the three countries are national average inventories. In addition, it also is important to be able to develop emission projections that properly take into account key factors that influence future emissions—

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changes in meteorological conditions caused by climate change and behavioral changes that are influenced by climate change.

In the critiques of individual country databases, a number of key areas for improvement have been outlined. The high priority areas, applicable to all three countries include treatment of chemical speciation, difficult to measure and assess chemicals, and adequate characterization of source categories. Of particular concern are emissions related to trade and additional monitoring needed to assess impacts related to these emissions. Developing procedures for characterizing climate change-sensitive emission projections and planning for commensurate future monitoring needs pose the greatest challenge.

Improvement in inventory development and monitoring in all countries will benefit from periodic rethinking of how best to use the systems for multiple, evolving, and emerging environmental concerns; ensuring that approaches are flexible enough to take advantage of technology advances that can lead to improved collection and distribution of data; and promoting continued evaluation of quality assurance and use of resulting improved protocols.

North American air quality management will benefit from the following:

- Expanded coordination of information development with special attention on compatibility of processes; issue assessments including the full scope of North American concerns; planning with special focus on capacity building and leveraging resources; and communication strategy development for multiple users and needs across countries.
- Centralized North American air quality information web portal for data, documentation of data development and protocols, reports on use of the data and evaluation of data, presentations of summary information for multiple audiences, and planning activities.
- Eventual development of a consistent, comprehensive North American inventory that can simultaneously address all of the major air quality- and climate-related concerns with the help of sophisticated, state-of-the-art, gridded air quality models, and commensurate expansion of monitoring in all three countries to help consistently track changes in all key air quality issues.

Guiding principles for improving air quality management databases include:

- Building on existing efforts, including the North American working arrangements already in place through the CEC and others and the current planning for next steps in each country and
- Leveraging infrastructure and resources across countries to improve information development and sharing.

To make progress toward improved air quality management, specific steps dealing with emission inventory and monitoring network development are recommended. These are organized under

three major headings: coordination-communication-capacity building, information portal development, and data management planning.

The full background paper is available as:

North American Expert Consortium, Comprehensive Assessment of North American Air Emissions Inventories and Ambient Air Monitoring Networks, Commission for Environmental Cooperation, Montreal, September 2009.