Improving Emission Inventories for Effective Air Quality Management Across North America

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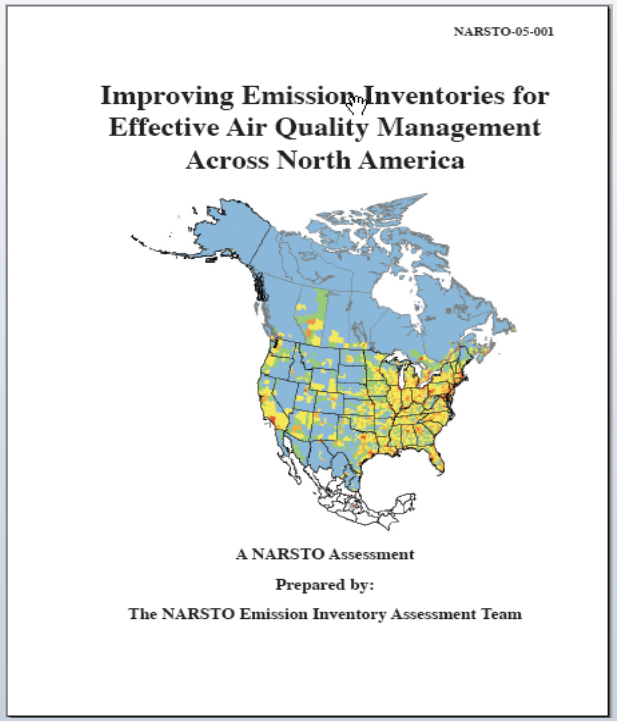

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NARSTO

- North American Strategy for Tropospheric Ozone (NARSTO)
- A multi-stakeholder, public-private partnership whose membership includes government, industries & academia across Canada, Mexico, and the United States
- NARSTO's activities provide input for science-based decision-making and determination of workable, efficient, and effective strategies for local and regional air pollution management

NARSTO Emission Inventory Assessment
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* Denotes Co-Chairs

\# Denotes Lead Authors

Motivation for the Assessment

- **Previous NARSTO Assessments (PM & Ozone), and an Emission Inventory Workshop (2003) recommended improvements in the emission inventory programs**

- **NARSTO decided to conduct an Assessment of the emission inventory in North America in the fall of 2003**

  - **The NARSTO community can help bring together the needed improvements**

Motivation for the Assessment

- **Current inventories can support many emission management and regulatory activities**
  - **Emission inventories are critical elements in air quality management activities**
  - **Many improvements have been achieved in North America over the past 30 years in terms of accuracy and completeness of the emission inventories**
- **Deficiencies in current emission inventories may affect the capacity to effectively resolve future air quality problems**

Motivation for the Assessment

- **Increased investment in emission inventories can increase the probability that controls are cost-effective in protecting the environment and human health**
  - **Houston Texas case showed “savings” of $9B over a 10 year period with revised emission inventory and a revised control strategy**

NARSTO Emission Inventory Assessment

Audience for the Assessment

- Decision/policy makers
- Users of emission inventories
- Developers of emission inventories

Vision statement that sets the goal for future Emission Inventories

- The ultimate emission inventory is one that includes all significant emissions from all sources, time periods, and areas with quantified uncertainties and timely accessibility

Outline of the Emission Inventory Assessment

- Executive Summary
- Chapters

1. Introduction, background and objectives
2. Vision for future emission inventory programs
3. Current status of North American emission inventories
4. Tools for developing emission inventories
5. Strengths and weaknesses of current emission inventories
6. Innovative technologies and applications
7. Top-down assessments of emission inventories
8. Methods for the assessment of the uncertainty and sensitivity
9. Recommendations and conclusions

Outline of the Emission Inventory Assessment

- **Appendices**
  - **Source test methods used in Canada, the United States, and Mexico**
  - **Concept and methods for uncertainty and sensitivity analysis**

Key Findings and Recommendations

- The assessment provides a total of 8 findings and recommendations
- Applicable to Canada, the United States, and Mexico

Key Findings and Recommendations

1. Reduce The Uncertainty Associated With Emissions from Key Undercharacterised Sources

Finding

- Few source categories are well characterized and reported;
- Many source categories are uncertain, especially nonpoint sources (transportation, fugitives, landfills, sewage disposal, etc.)

Recommendation

- Focus immediate measurement and development efforts on areas of greatest known uncertainty
- Systematically apply sensitivity and uncertainty analyses to identify subsequent improvement priorities

Key Findings and Recommendations

Top 10 Priorities for Emission Inventory Improvements

- Size segregated and speciated emissions of fine particles and precursors including black and organic carbon
- Toxic and hazardous air pollutants
- Emissions from onroad vehicles
- Emissions from agricultural and other area sources, especially ammonia
- Biogenic emissions (speciated, spatially and temporally resolved)
- Petrochemical and other industrial facilities (VOC's and organic HAPS)
- Off road mobile sources (including farm and construction equipment, aircrafts and airport ground equipment, commercial marine, locomotives)
- Open biomass burning (agricultural and forest prescribed burning, residential backyard burning)
- Residential wood combustion
- Paved and unpaved road dust

Key Findings and Recommendations

2. Improve Speciation Estimates

Finding

- Detailed information about the species being emitted from different sources is required
- Important for PM and ozone non-attainment areas, HAPs “hot spots”, and other programs

Recommendation

- Develop new and improve existing source speciation profiles, emission factors, and activity data for PM and precursors, VOC’s, and hazardous air pollutants

Key Findings and Recommendations

3. Improve Existing and Develop New Emission Inventory Tools

Finding

- Technical advances in instrumentation and computation have allowed new measurements and analyses not previously possible
- Continuing improvements in these technological capabilities (measurements, modeling and data processing) will provide the basis for more detailed and more accurate emission models and processors

Recommendation

- Continue the development of new and existing measurement and analysis technologies
- Apply these technologies to allow the models and processors to more closely approximate actual emissions in time and space

Key Findings and Recommendations

4. Quantify and Report Uncertainty

Finding

- The emission inventories, processors, and models used in Canada, the United States, and Mexico are poorly documented for uncertainties (the reliability of the emission estimates cannot be quantified)

Recommendation

- Develop guidance, measures, and techniques to improve the uncertainty quantification, and include measures of uncertainty as a standard part of reported emission inventory data

Key Findings and Recommendations

5. Increase Emission Inventory Compatibility and Comparability

Finding

- There are numerous emission inventories developed by different organizations for different purposes and covering different spatial domains
- More efforts are needed to make these emission inventories more comparable across organizations, purposes, geographies and time period

Recommendation

- Define and implement standards for emission inventory structure, data documentation, and data reporting for North American emission inventories

Key Findings and Recommendations

6. Improve User Accessibility

Finding

- The accessibility of emission inventories and emission models is presently very limited (large size, and cumbersome archiving methods)
- Improved accessibility is critical to meet the diverse needs of the user community

Recommendation

- Improve user accessibility to emission inventory data, documentation, and emission inventory models through the Internet or other electronic formats *(ftp site, agreed data formats and protocols)*

Key Findings and Recommendations

7. Improve Timeliness

Finding

- Timely and historically consistent emission inventories are crucial elements for stakeholders to assess current conditions and estimate progress in improving air quality

Recommendation

- Create and support a process for preparing and reporting national emission inventory data on a yearly basis
  - Reduce the current emission inventory cycles
  - Will require new investments in personnel and data processing capacity
  - Need to balance timeliness and the required level of quality assurance

Key Findings and Recommendations

8. Assess and Improve Emission Projections

Finding

- Emission projections are critical to developing control strategies for attaining air quality standards and goals, and for evaluating future year impacts associated with regulatory development

Recommendation

- Emission projection methodologies for all inventory sectors in North America should be evaluated to determine the accuracy of past projections and identify areas of improvement for future projections

Implementing The Recommendations

- Will require money, expertise, and time
- An action plan is provided for Canada, the United States, and Mexico
  - Identify the first steps towards implementing the 8 recommendations
  - Initial cost estimates for these action plans are provided as a starting point for additional discussions and additional funding

Implementing The Recommendations

- **Funding for emission inventories is a small part of air pollution control costs in North America**
- **Example**
  - **Air pollution control costs in the United States**
    - $19B in 1999; $27B in 2010
  - **Current funding for emission inventories in the United States**
    - $25M/year
  - **For every $1,000 spent to meet the *Clean Air Act* requirements, about $2 is spent to characterize the emissions**

Additional Funding Identified

Current emission inventory funding (USD)

- United States $25M/year
- Canada $ 6M/year
- Mexico $0.6M/year

Initial Action Plans identified the following additional costs

- United States ~$35M/year
- Canada ~$ 6M/year
- Mexico: ~$ 7M/year

(for the next 3 - 5 years)

Conclusions

- **Emission inventories (*essential for achieving air quality improvements*) face challenging requirements over the next 10 years**
- **The findings, recommendations, and action plans provide specific direction for future developments and begin to identify the required resources to achieve the necessary improvements**
- **Continued collaboration and coordination between Canada, the United States and Mexico will enhance the effectiveness of the individual efforts**
- **Significant public and private expenditures will be needed to address the priorities and long-term needs**

Disclaimer

Although this material has been reviewed and approved for presentation, any views expressed by the authors do not necessarily reflect the views of the U.S. Environmental Protection Agency, Environment Canada, National Institute of Ecology-SEMARNAT, or NARSTO member organizations

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