Improving Emission Inventories for Effective Air-Quality Management Across North America –

A NARSTO Assessment

by

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for the

EPA Emission Inventory Conference

on

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in

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NARSTO

- **A multi-stakeholder, public-private partnership of government, private sector, & academia across Canada, Mexico, & U.S.**

- **NARSTO's activities provide input for science-based decision-making and determination of workable, efficient, and effective strategies for reducing air pollution.**

NARSTO
Emission Inventory Assessment

- **NARSTO's PM Assessment, Ozone Assessment, and Emission Inventory Workshop indicated a need for an Emission Inventory Assessment.**
  - **Emission inventories will continue to be important in air quality management activities.**
  - **A quantum leap is needed in tools and techniques.**
  - **The NARSTO community can help bring about the needed improvement.**

NARSTO Emission Inventory Assessment
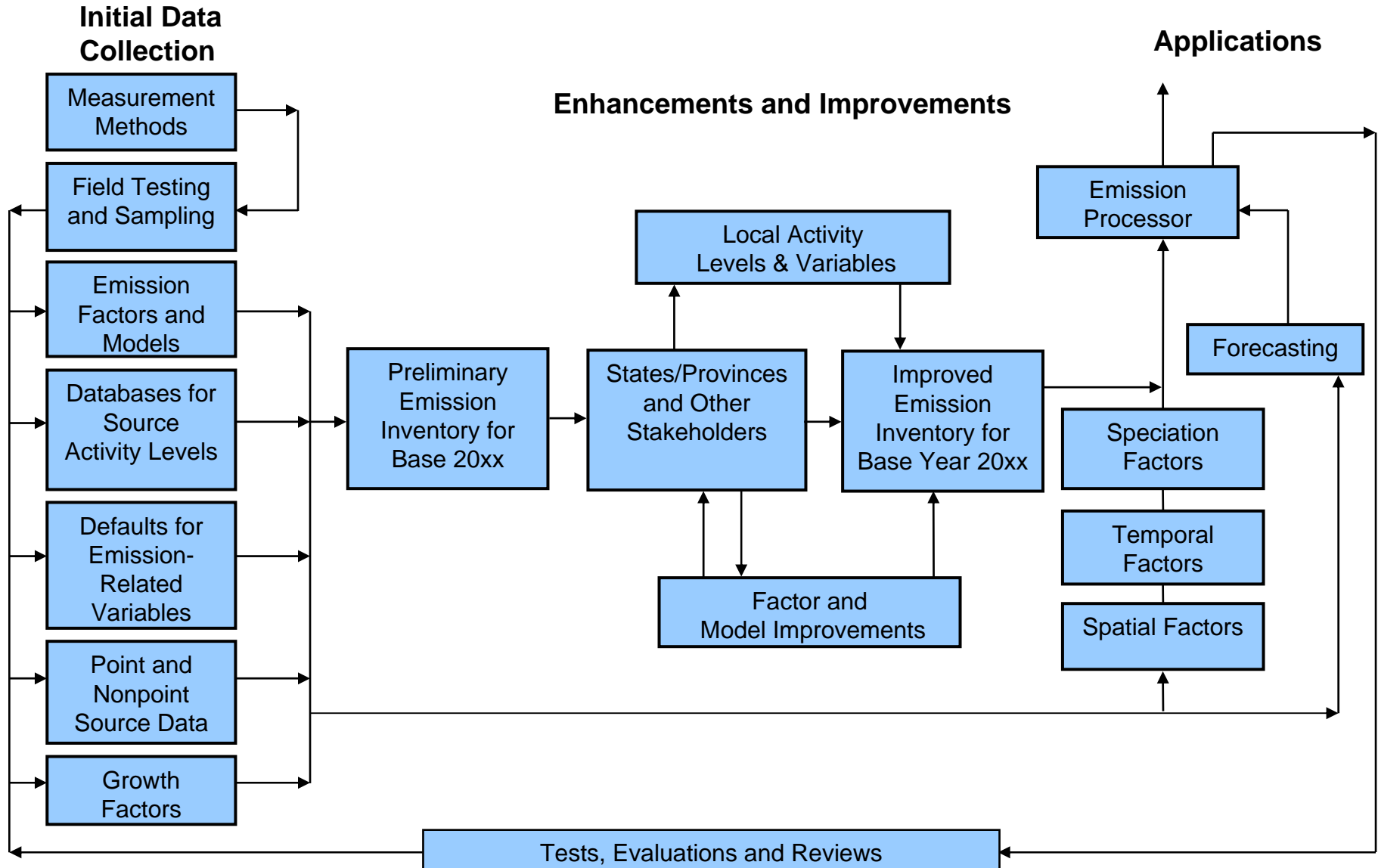
- **Emission inventories influence:**
    - *Control Strategy Development*
    - *Cap and Trade Programs*
    - *Air Quality Forecasting*
    - *Field Studies*
    - *Risk Assessments*
    - *Economic Incentive Programs*
    - *New Source Review*
    - *Global Climate and International Transport*
    - *Accountability and Assessment*
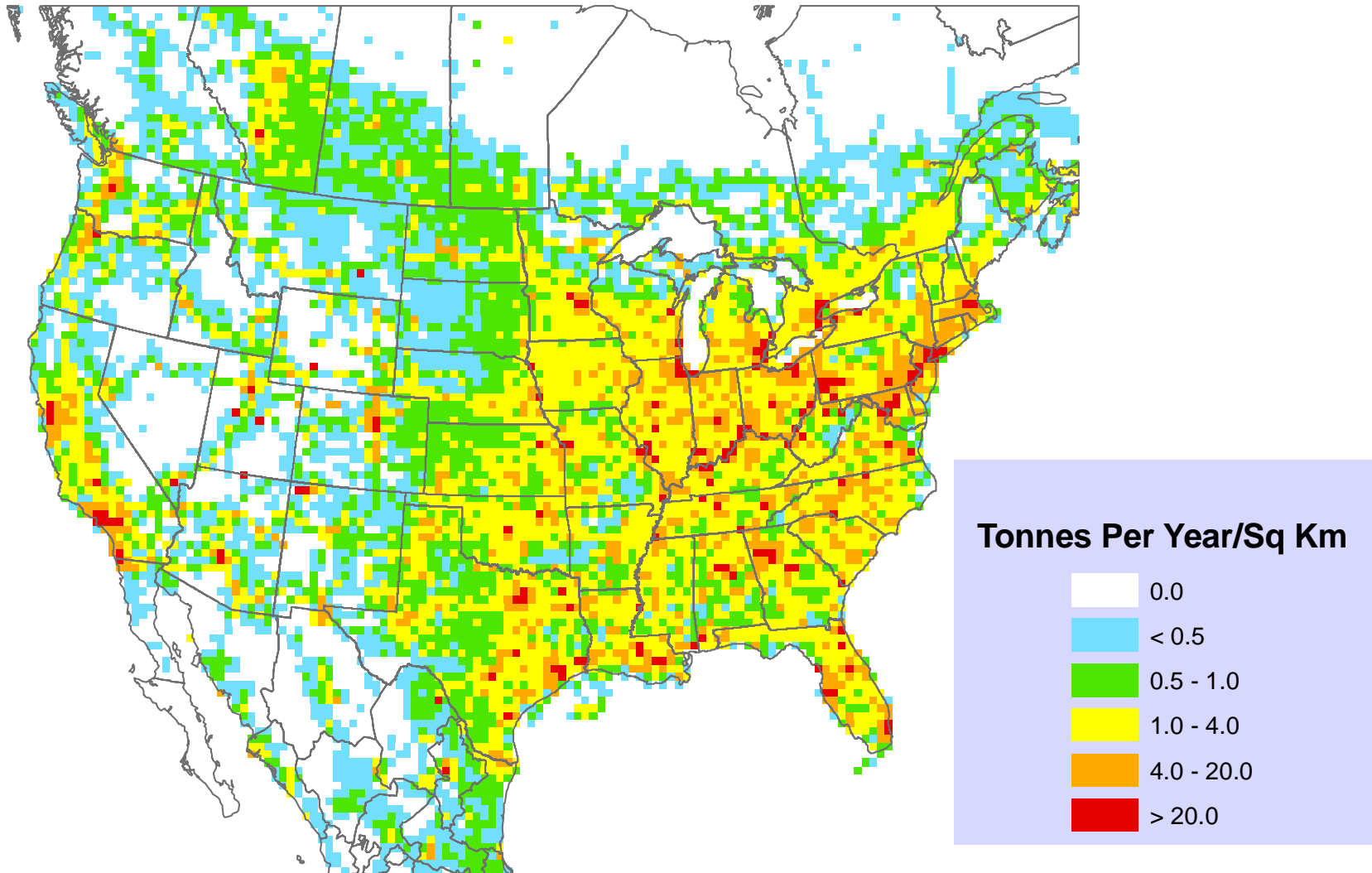   - *Compliance Assurance*

NARSTO Emission Inventory Assessment

- **New and innovative tools and techniques are available:**
  - *Satellites, aircraft and other remote sensing techniques*
  - *Measurement and monitoring instrumentation and protocols including continuous emission monitoring systems*
  - *Computer software and hardware including the Internet and GIS capabilities*
  - *Analysis and application methods including emission and air quality modeling*

Emission Inventory Process

Initial Data Collection

- Measurement Methods
- Field Testing and Sampling
- Emission Factors and Models
- Databases for Source Activity Levels
- Defaults for Emission-Related Variables
- Point and Nonpoint Source Data
- Growth Factors

Enhancements and Improvements

Applications

- Local Activity Levels & Variables
- Preliminary Emission Inventory for Base 20xx
- States/Provinces and Other Stakeholders
- Improved Emission Inventory for Base Year 20xx
- Factor and Model Improvements
- Emission Processor
- Forecasting
- Speciation Factors
- Temporal Factors
- Spatial Factors

Tests, Evaluations and Reviews

NOx Emissions
(1999)

Tonnes Per Year/Sq Km

- 0.0
- < 0.5
- 0.5 - 1.0
- 1.0 - 4.0
- 4.0 - 20.0
- > 20.0

NARSTO Emission Inventory Assessment

- **Objectives:**

  - **To promote efficient and effective use of current inventories;**

  - **To set the stage for improving future emission inventories; and**

  - **To establish a roadmap for the future.**

NARSTO Emission Inventory Assessment

- **Audience:**
  - **Decision makers**
  - **Users of emission inventories**
  - **Developers of emission inventories (Canada, Mexico, & USA)**

NARSTO Emission Inventory Assessment

- **Proposed Schedule:**
  - **Kickoff @ NARSTO EI Workshop – 10/03**
  - **NARSTO & Public Review Draft – 10/04**
  - **Revisions & Response to Comments**
  - **External Peer Review – 02/05**
  - **Revisions & Response to Comments**
  - **Presentation at NARSTO Executive Assembly & EPA Emission Inventory Conference -- 04/05**
  - **Final Report Release at AWMA Meeting – 06/05**

NARSTO Emission Inventory Assessment

- **Report Outline:**
  1. Introduction, background and objectives
  2. Vision for emission inventory programs
  3. Current status of North American emission inventories
  4. Tools for developing emission inventories
  5. Strengths, weaknesses, and lessons learned
  6. Evolving technology and methods
  7. Top-down assessments of emission inventories
  8. Uncertainty and sensitivity analysis
  9. Recommendations and conclusions

NARSTO Emission Inventory Assessment
Steering Committee

- Michael Benjamin, CARB
- Kevin Black, DOT/FHWA
- Garry Brooks, ERG
- Steve Cadle, GM
- Marc Deslauriers, Env Canada*
- Cyril Durrenberger, U of TX
- Stephan Falke, Wash Univ
- Howard Feldman, API*
- Paula Fields, ERG
- Chris Frey, NC State*#
- Veronica Garibay Bravo, Mexico
- Jake Hales, NARSTO/Envair#
- Bernd Haneke, MACTEC#
- George Hidy, Envair#
- Les Hook, Oak Ridge
- Sarah Kelly, Tribal Professionals
- Chuck Kolb, Aerodyne#
- Bill Kuykendal, EPA/OAQPS
- Luisa Molina, MIT

- Andy Miller, EPA/NRMRL#
- David Mobley, EPA/NERL*#
- Doreen Neil, NASA
- Dave Niemi, Env Canada
- Tim Parkin, USDA
- David Parrish, NOAA#
- Tom Pierce, EPA/NERL
- Bill Pennell, NARSTO
- Leonora Rojas Bracho, Mexico*
- David Streets, Argonne
- Gene Tierney, EPA/OTAQ
- Art Werner, MACTEC#
- Jeff West, NARSTO
- Roger Westman, Allegheny Co
- Susan Wierman, MARAMA*
- Jim Wilson, Pechan
- Allen Zheng, NC State

* Denotes CoChair
# Denotes Lead Authors

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NARSTO Emission Inventory Assessment

Preliminary findings and recommendations:

- **Recommendations are in two tiers in order of priority;**
    - **First Tier – Address Priority Needs for Reducing Uncertainty**
    - **Second – Data   Process**
        - **Speciation   Compatibility**
        - **Tools   Accessibility**
        - **Uncertainty   Timeliness**
        - **Projections**

- **Recommendations are intertwined and investment in multiple activities may be appropriate;**

    (Findings and recommendations are still undergoing review)

Key Findings and Recommendations

1. **Address Priority Emission Inventory Needs**

- *Finding*
- Few source categories are well characterized and reported;
- Many source categories are uncertain especially nonpoint sources
- *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

1. **Address Priority Emission Inventory Needs (Top 10)**
- **Fine particles and their precursors**
- **Toxic and hazardous air pollutants**
- **Onroad motor vehicles**
- **Agricultural sources, especially ammonia**
- **Biogenic sources**
- **Petrochemical industrial facilities**
- **Off-road mobile sources**
- **Open biomass burning**
- **Residential wood combustion**
- **Paved and unpaved road dust**

Key Findings and Recommendations

2. Improve Emission Inventory Speciation Estimates

- *Finding*
- **Detailed information about the species being emitted from sources is needed for PM, Ozone, HAPs and other programs.**
- *Recommendation*
- **Develop new and improve existing source speciation profiles and emission factors**

Key Findings and Recommendations

3. Improve Existing and Develop New Emission Inventory Tools

- *Finding*

- **Improvements in technology (measurements, modeling and data processing) capabilities provide the basis for more detailed and more accurate emission models and processors.**

- *Recommendation*

- **Apply these technologies in developing emission model and processor capabilities to allow models to more closely approximate actual emissions.**

Key Findings and Recommendations

4. Quantify and Report Uncertainty

- *<u>Finding</u>*

- **The emission inventories, processors and models of Canada, the United States, and Mexico are poorly documented for uncertainties.**

- *<u>Recommendation</u>*

- **Develop guidance, measures, and techniques to improve 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.** *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 or emission models is presently very limited.**

- *Recommendation*

- **Improve user accessibility to emission inventory data, documentation, and emission inventory models through the Internet or other electronic formats.**

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.**

Key Findings and Recommendations

8. Assess and Improve Emission Projections

- *Finding*
- **Emission projections are critical to developing control strategies for attaining air quality standards.**

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

Implementation of Recommendations

Recommended actions common to
Canada, Mexico & US:

- **Implementation should be led by key Federal agencies:**
  Environment Canada, SEMARNAT, USEPA
- **Federal support needs to continue.**
- **Interactions and collaborations among and across Canada, Mexico, and US should be maintained and enhanced.**
- **Increased training needed.**

Implementation of Recommendations

Current Funding for Emission Inventories:

- US $25M
- Mexico   0.6M
- Canada   6M

Implementation of Recommendations

Action Plan for Canada:

- **Improve the emission inventory for PM2.5 and its precursors.**

- **Improve speciation profiles for PM and VOCs.**

- **Improve point source emission estimates.**

- **Update the national emission inventory database.**

- **Improve the timeliness for the dissemination of the national emissions inventory trends and projections.**

- **Engage appropriate stakeholder groups to develop a national strategy to implement the eight recommendations of the Assessment.**

Additional Cost: ~$9M

Implementation of Recommendations

Action Plan for Mexico:

- **Complete the National Emission Inventory for Mexico.**

- **Develop and implement a communications strategy to disseminate the results of the NEI.**

- **Develop and fulfill requirements at the national level to enable emission inventory updates on a three-year cycle.**

- **Build emission inventory development capacity among state environmental agencies.**

- **Expand capabilities among Mexican agencies.**

Implementation of Recommendations

Action Plan for Mexico (continued):

- **Continue to improve the capabilities to develop emission inventories through interactions with the U.S.**

- **Improve programs to conduct direct emission measurements by identifying sources needed to develop Mexico-specific emission factors and by developing vehicle fleet characterization data for mobile sources.**

- **Develop a national data system.**

- **Increase human resources available for emission inventory compilation, maintenance and update.**

Additional Cost: ~$5M

Implementation of Recommendations

Action Plan for US:

- **Enhance the emission inventories and associated tools for PM2.5 and its precursors**

- **Improve the capacity of state, local, and tribal agencies to develop inventories to meet regulatory requirements.**

- **Develop emission inventory reporting requirements and integrate inventory data for hazardous air pollutants.**

- **Engage appropriate stakeholder groups to develop action plans to implement the full range of recommendations.**

- **Increase support of research to develop and improve emission inventories.**

Additional Cost: ~$35M

Key Findings and Recommendations

- **Implementation of Recommendations:**

- **Finding: Emission inventory programs need significant additional resources across all stakeholders over an extended period of time to enhance tools and techniques and expertise.**

- **Recommendation: Increase resource allocations for emission inventories in the range from double to an order of magnitude of current investments; develop detailed plans and cost estimates to implement the recommendations.**

Summary

- **Accurate emission inventories are the foundation of cost-effective air quality management.**

- **NARSTO Emission Inventory Assessment shows how progress can be made to improve emission inventories in the future for enhanced quality, timeliness, and cost.**

- **Significant investment by government agencies and the private sector is needed.**

- **For more information and a copy of the current draft, reference: http://www.cgenv.com/narsto.**

Disclaimer

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