Emissions Inventory Development for Fine-Scale Air Quality Modeling

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Emissions Inventory Development for Fine-Scale Air Quality Modeling (1 of 2)

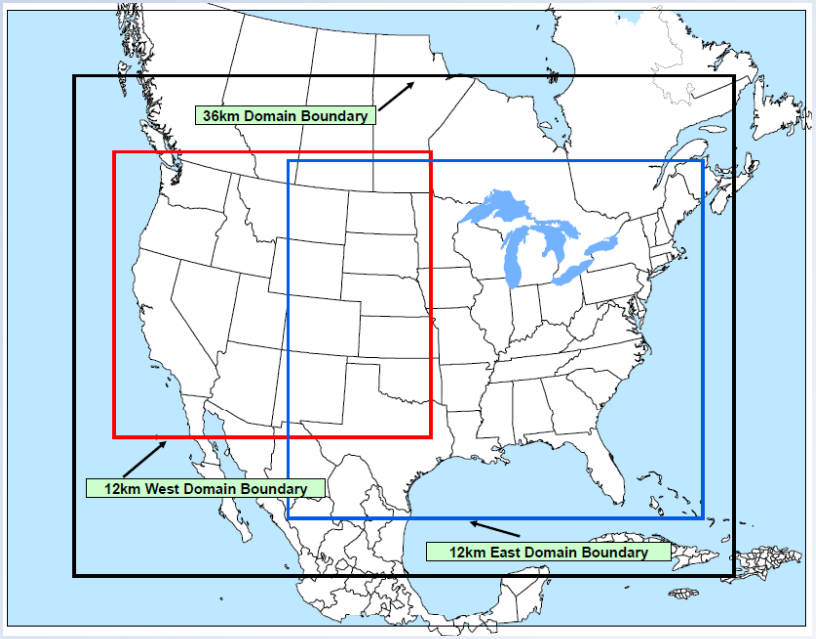
- Project background
- Who was involved, how we did our work
- What we learned
- Recommendations for agencies that want to develop inventories for fine-scale modeling
- Proposed next steps

Background (1 of 2)

Increasing attention is being given to resolving pollutant concentrations at finer spatial scales than are traditionally used for regulatory and policy assessments

Coarse-resolution modeling

- Fails to capture local source impacts on ambient $PM_{2.5}$ concentrations
- Cannot resolve air toxics “hot spots” where fine-scale concentration gradients exist

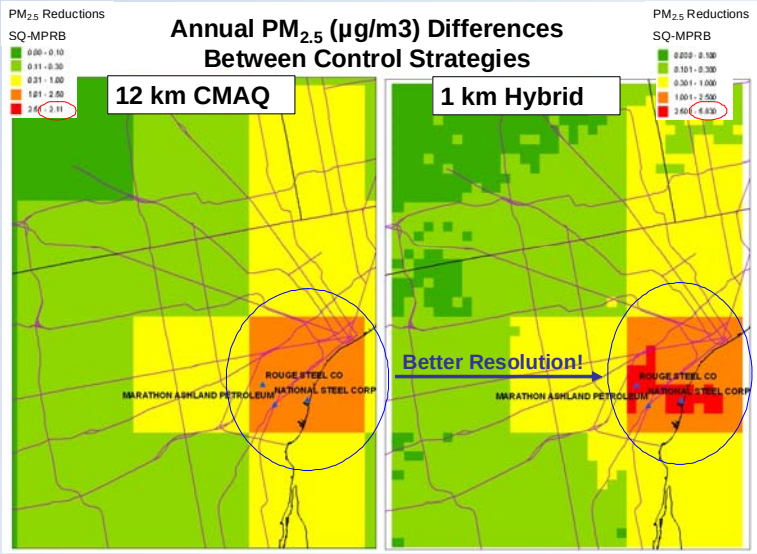


36-km and 12-km CMAQ modeling domains for EPA’s 2005-based platform

Background (2 of 2)

EPA's Detroit multi-pollutant pilot project

- Examined $PM_{2.5}$, ozone, air toxics from a risk-based perspective
- Evaluated sources for possible co-control of multiple pollutants
- Hybrid CMAQ (12-km) and AERMOD (1-km) modeling to account for local source contributions



What is a local-scale inventory?

- Focus on improving information for key sources
- ‘Ground-truth’ emissions to be more locally representative
  - operational variability
  - emission rates
  - existing controls
  - specific locations of emission releases
- Rather than generalized approach to estimate annual emissions, i.e., default emission rates, average operating profiles, average activity statistics

Local-Scale EI Focus Group

Purpose

- Build capacity in EPA's EIAG and the state and local inventory community for developing more locally representative emissions estimates

Objectives

- Identify analyses that can assist state/local agencies with local-scale inventory development
- Prioritize beneficial analyses and methodologies
- Examine linkages between local-scale EIs and the NEI

Technical Approach (1 of 2)

EPA recruited staff from state/local agencies that are developing local-scale EIs for fine-scale modeling

Agency	Staff Members
Core Participants	
Allegheny County (PA) Health Department	Jayme Graham Jason Maranche
Alabama Department of Environmental Management	Leigh Bacon Lisa Cole Tim Martin
Cleveland Division of Air Quality	David Hearne
Georgia Department of Natural Resources	Jim Boylan Byeong Kim
Illinois Environmental Protection Agency	Jeff Sprague Buzz Asselmeier
Missouri Department of Natural Resources	Jeff Bennett Stacey Allen
Wyoming Department of Environmental Quality	Brian Bohlmann Ken Rairigh
Peer Reviewers and Other Participants	
Indiana Department of Environmental Management	Scott DeLoney Jeff Stoakes
Pennsylvania Department of Environmental Protection	Sherry Bogart
Maricopa County (AZ) Air Quality Department	Bob Downing
Maricopa Association of Governments	Matt Poppen
Pinal County (AZ) Air Quality Control Division	Kate Edwards
Puget Sound (WA) Clean Air Agency	Kathy Himes Strange
EPA Region 3	Alice Chow
EPA Region 7	Steven Brown
EPA Region 8	Mark Komp

Technical Approach (2 of 2)

- Focus group met via teleconference biweekly from June 15 to Sept 14, 2010
- Presentations and discussions centered on five charge questions (see box)
- Agencies provided EPA and STI with technical support documents for review

Charge Questions

- *What type of air quality problems were addressed?*
- *What analysis techniques were used?*
- *Which emissions source categories were addressed?*
- *What changes to emissions estimates and modeling results occurred?*
- *Would any NEI-related analyses be beneficial to these efforts?*

Air Quality Problems Addressed (1 of 3)

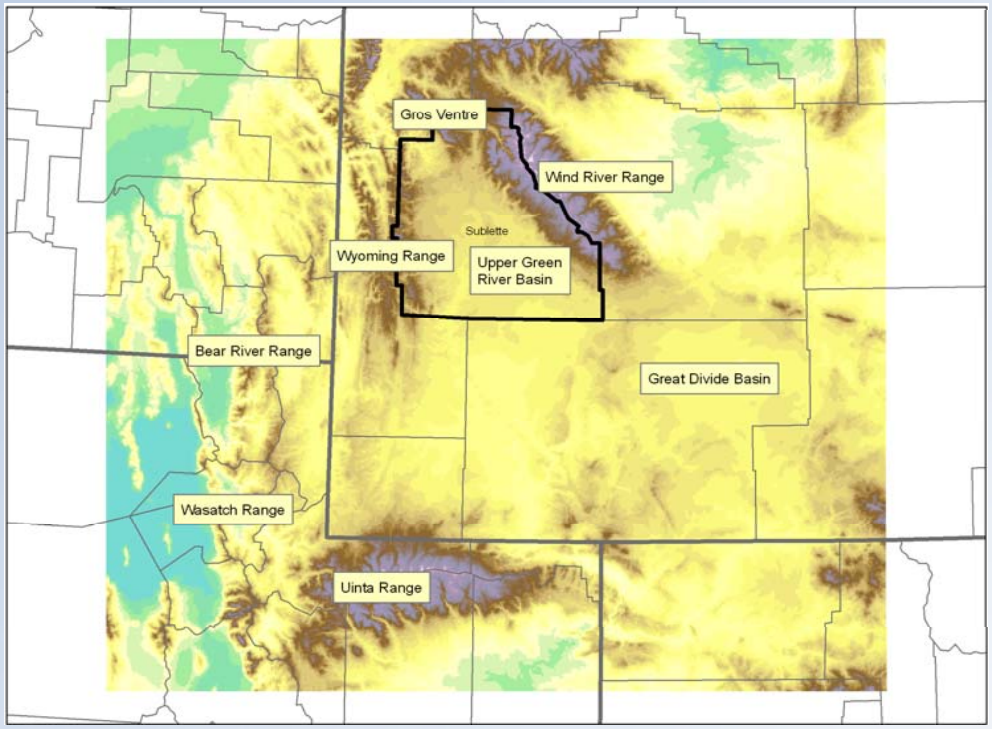
$PM_{2.5}$ attainment issues

Non-attainment area	Agency
Liberty-Clairton	Allegheny County HD
St. Louis (Granite City, IL)	Illinois EPA
Atlanta	Georgia DNR
Birmingham	Alabama DEM

Air Quality Problems Addressed (2 of 3)

Ozone attainment issues

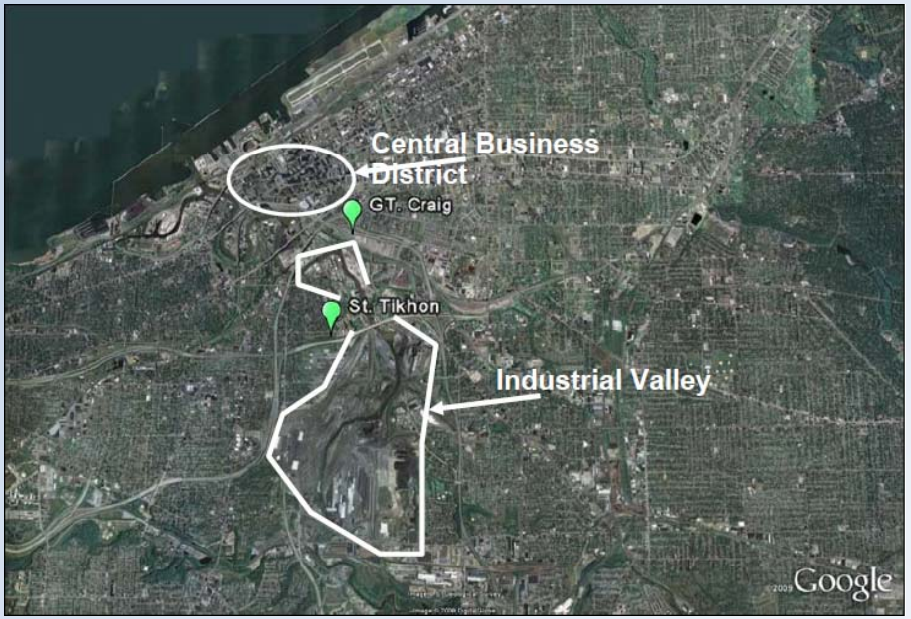
Areas of concern	Agency
Upper Green River Basin (Sublette Co.)	Wyoming DEQ
Birmingham, Huntsville, Mobile, Montgomery	Alabama DEM



Air Quality Problems Addressed (3 of 3)

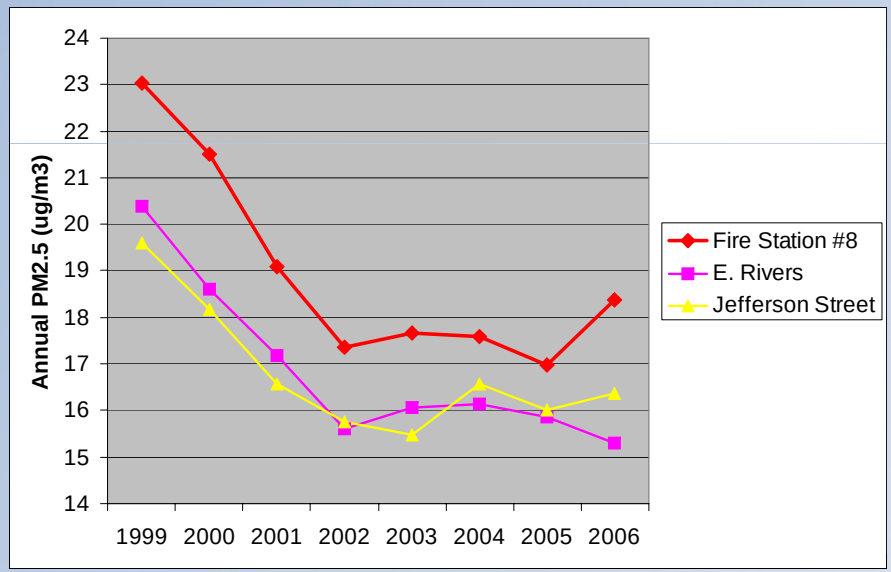
Multi-pollutant analyses

Study	Agency
Cleveland Multiple Air Pollutant Study (CMAPS)	Cleveland DAQ, EPA, others
St. Louis Air Quality Management Plan (AQMP)	Illinois EPA, Missouri DNR

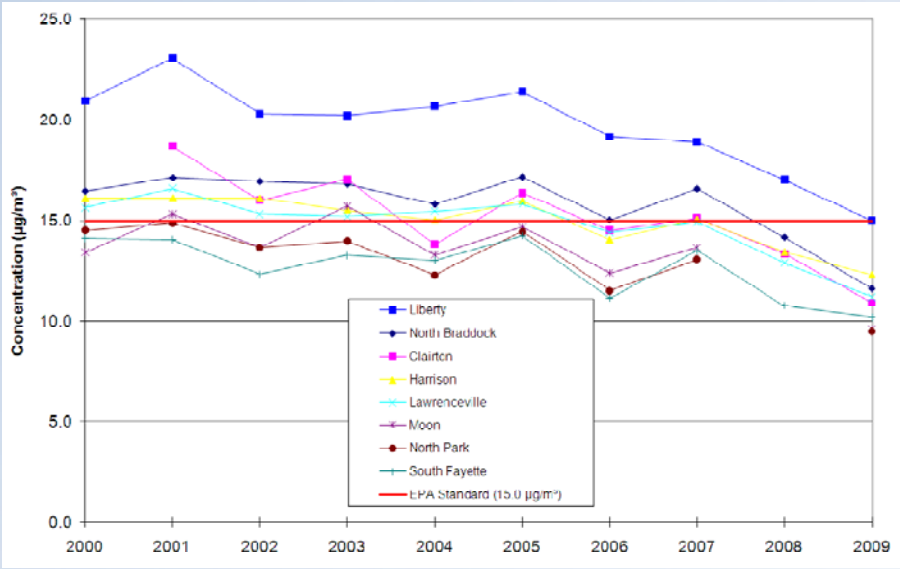


Analysis Techniques (1 of 4)

Inter-monitor comparisons



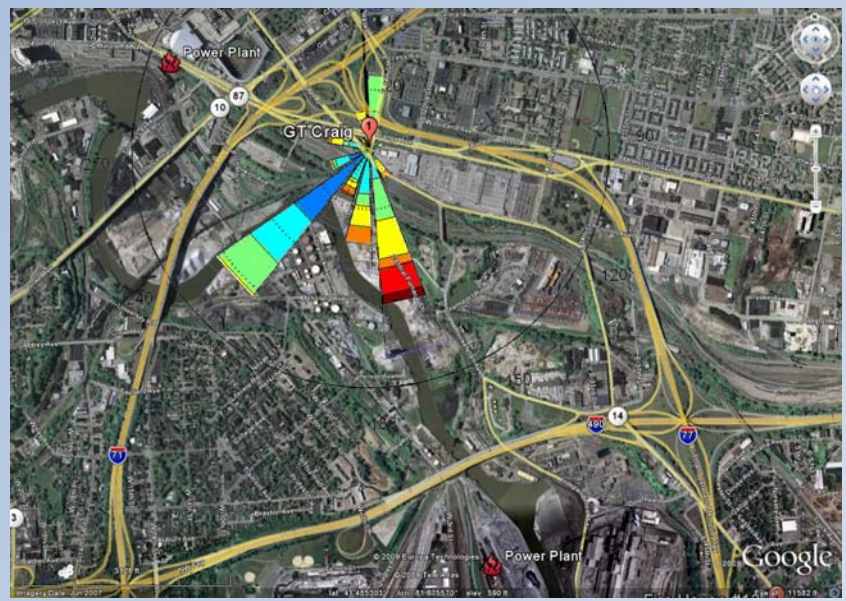
From focus group presentation by Georgia Dept. of Natural Resources (DNR) on July 13, 2010



From focus group presentation by Allegheny Co. Health Department (HD) on July 13, 2010

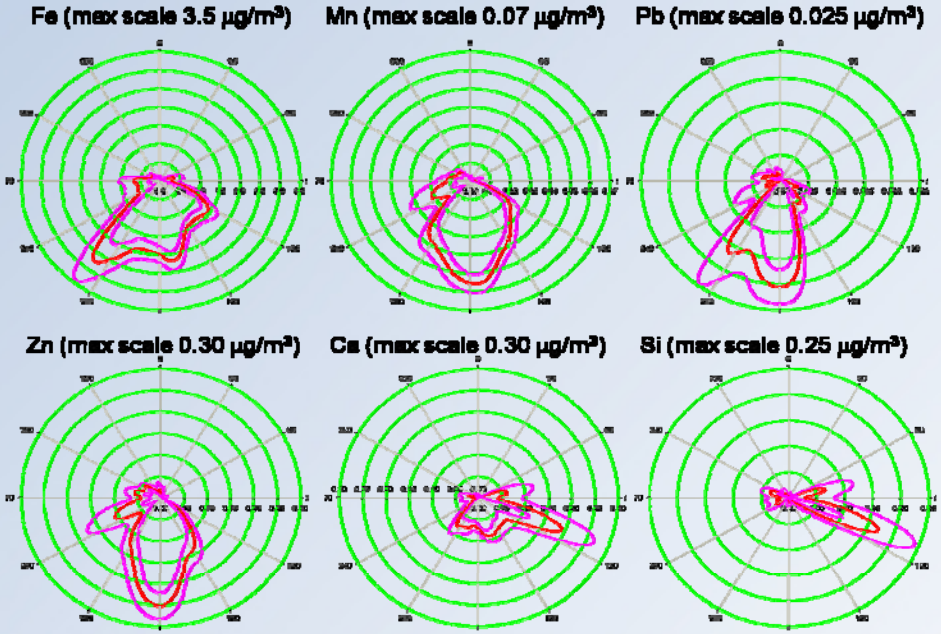
Analysis Techniques (2 of 4)

Wind direction analyses



NO_2 pollution roses for Cleveland

(Source: EPA ORD)

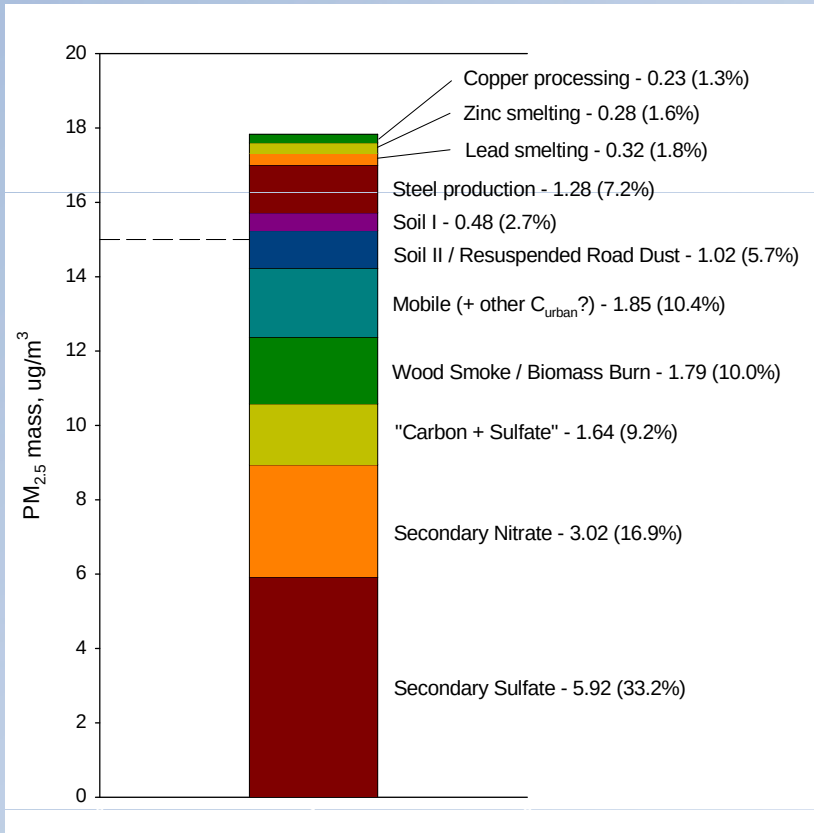


Speciated $PM_{2.5}$ pollution roses for Granite City, IL

(From focus group presentation by Illinois EPA on July 27, 2010)

Analysis Techniques (3 of 4)

Receptor modeling (PMF)



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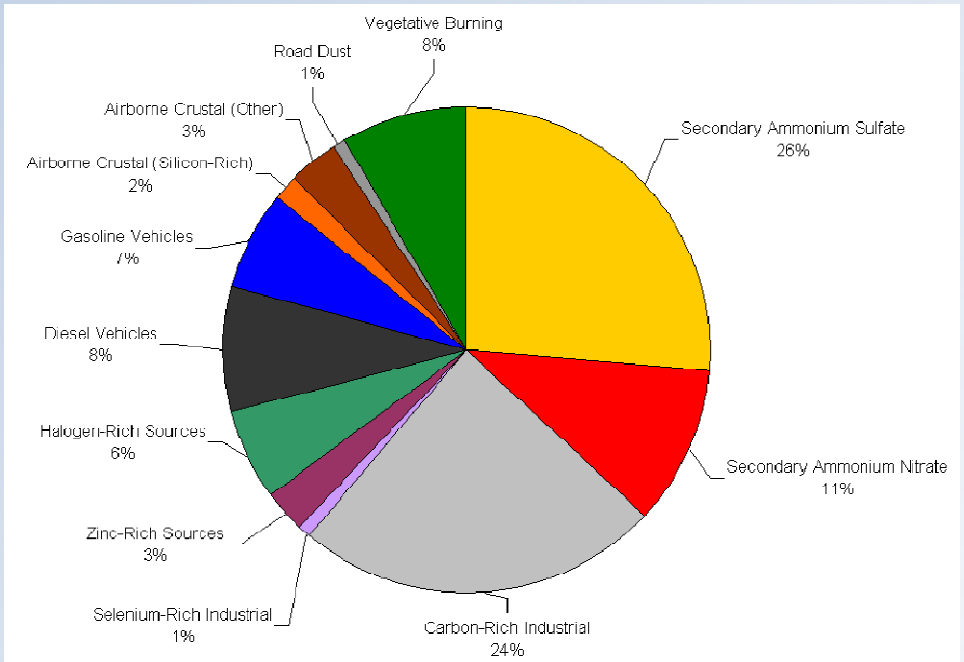


From focus group presentation by Allegheny Co. HD on July 13, 2010

Analysis Techniques (4 of 4)

Other analyses

- Ranking local sources by emissions levels (Georgia DNR)
- Calculating emissions (Q) to distance-from-monitor (D) ratios (Q/D) for individual sources (Alabama DEM)
- Fence-line sampling at key industrial facilities (Alabama DEM)

Inventory Improvement Methods (1 of 4)

Industrial facilities

- Contact facility owners/operators to gather emissions data, operating schedules, activity and production data, control information, etc.
- Work with permit program and/or facility engineers to evaluate physical characteristics, i.e., update stack parameters, release locations, existing control units
- Stack testing to develop new emission factors
- Develop facility-specific inventories for sites not previously treated as point sources

Inventory Improvement Methods (2 of 4)

Industrial facilities

CMAPS

- Identified 21 key facilities using permit data
- Invited facility reps to meet with EPA, CDAQ, and STI
- Conducted phone surveys to gather emissions, production, and operating data for two intensive monitoring months (Aug 2009 and Feb 2010)

Clairton (PA) coke plant

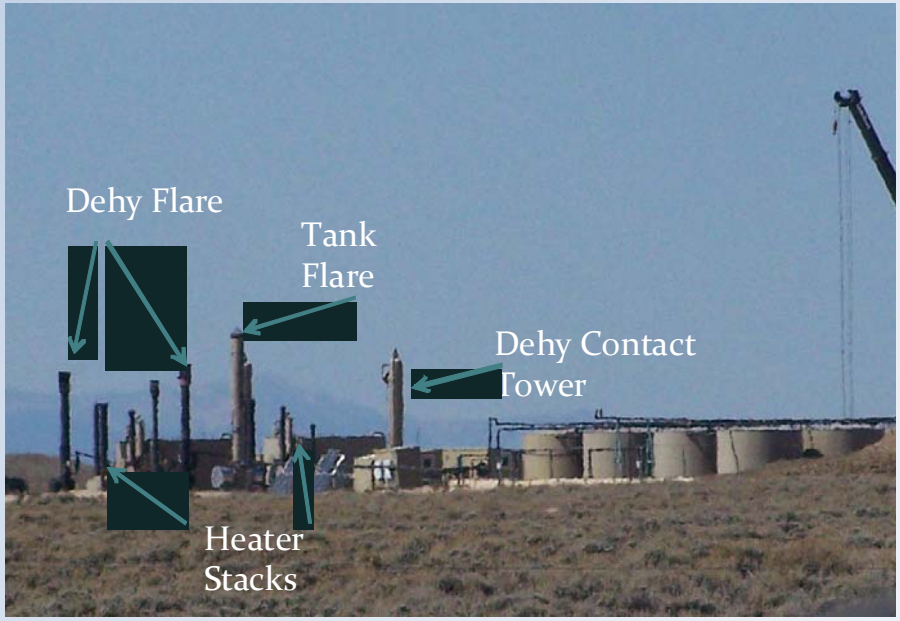
- Stack test on quench tower
- Increased condensable $PM_{2.5}$ emission factor from 0.00031 to 0.56 lb/ton of coal charged
- Decreased filterable $PM_{2.5}$ emission factor from 0.31 to 0.0785 lb/ton (due to the implementation of baffle washing)
- Overall $PM_{2.5}$ emissions 1,744 tons/year higher than NEI

Inventory Improvement Methods (3 of 4)

Non-point sources

Wyoming oil and gas wells

- Collected bottom-up emissions data on well-by-well basis
- Evaluated 14 sources (e.g., drill rigs, process burners, tanks, and dehydration units)
- Allows wells to be treated as individual point sources in air quality modeling applications



From focus group presentation by Wyoming DEQ on August 10, 2010

Inventory Improvement Methods (4 of 4)

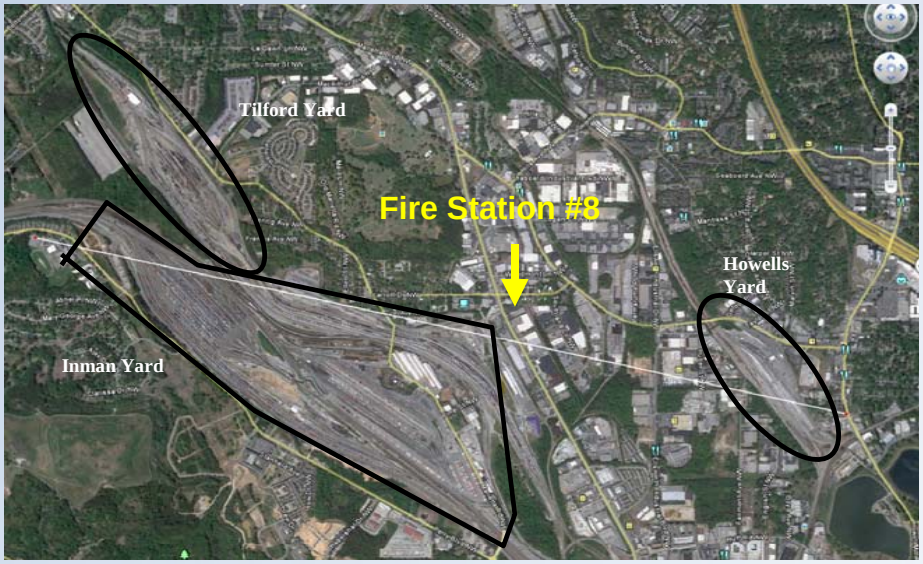
Non-road mobile sources

Atlanta rail yards

- Collected data on switcher, line haul locomotive usage
- Treated rail yards as volume sources in AERMOD
- Accounted for replacement of switchers with ultra-low emission Gensets

Port of Cleveland

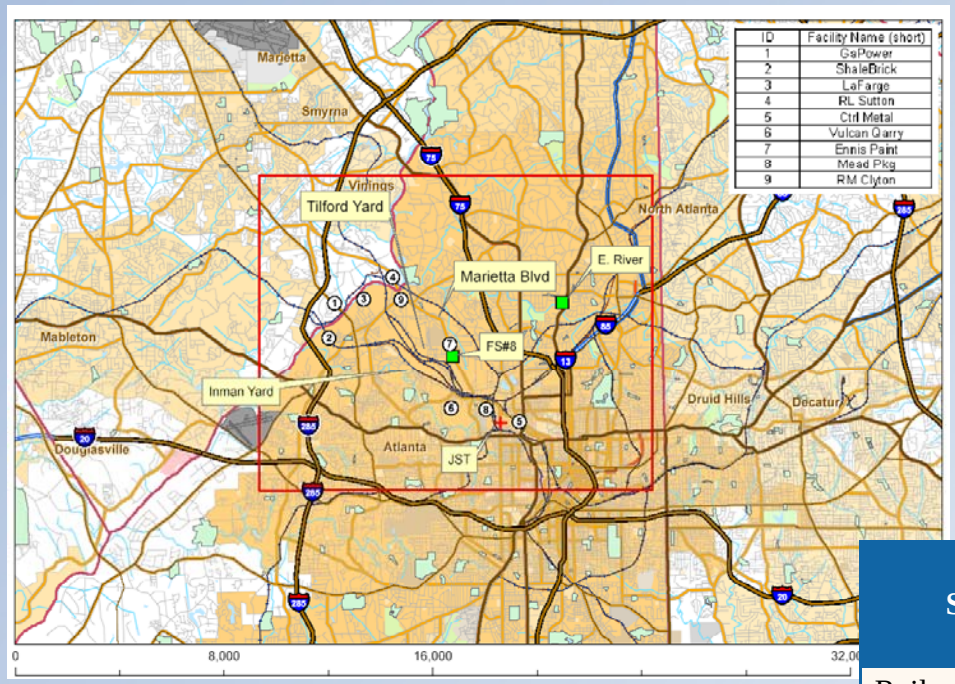
- 2005 NEI updated using 2009 vessel call data



From focus group presentation by Georgia (DNR) on July 13, 2010

Significance of Local-scale Improvements

Example: Atlanta local-area analysis



From focus group presentation by Georgia (DNR) on July 13, 2010

As a result of local-scale EI development and fine-scale modeling, the 2012 design value for the FS#8 monitor was lowered from 15.4 to 14.5 μg/m^3

Source	2002 $PM_{2.5}$ Contribution at FS#8 (μg/m^3)	2012 $PM_{2.5}$ Contribution at FS#8 (μg/m^3)	Reduction (μg/m^3)
Rail yards	1.9	0.6	1.3
On-road mobile sources	0.4	0.2	0.2
Industrial sources	1.3	1.3	0.0
Total	**3.6**	**2.1**	**1.5**

Findings and Recommendations (1 of 2)

Some recommended actions for local-scale inventory development

- Start with what you know – identify local emissions sources using existing inventories, permit data, etc.
- Communicate with facility owners/operators early and often using multiple approaches (letters, meetings, etc.)
- Understand your monitoring data thoroughly, particularly speciated data
- To evaluate local source contributions, use a weight of evidence approach (combine PMF, wind analyses, etc.)

Findings and Recommendations (2 of 2)

Potential barriers between local-scale inventories and the NEI

- The timing of inventory updates and modeling inventories
- Resource limitations
- Emissions thresholds
- Perceived usefulness of local data for other agencies

Proposed Next Steps

- Communicate the recommended first actions to state and local agencies that want to develop local-scale emissions
- Investigate perceptions about the relationship between local-scale inventories and the NEI, i.e, that local-scale emission characterizations are unlikely to impact regional modeling efforts and are of limited benefit to the NEI/ EIS
- Identify complementary NEI-based data analyses that can assist agencies' preparation for developing local-scale emissions inventories

Questions & Discussion

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