

OTC Modeling Committee Meeting Update



Buffalo NY
September 2, 2009

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NH DES



OTC Modeling Committee Overview

1. Planning and Multi-Pollutant Timing Considerations
2. Base year selection
3. Modeling platforms
 - a) MET year development
 - b) Inventory development
4. Modeling approach
5. Proposed Screening runs
6. Previous runs



OTC Modeling Committee Planning

The OTC Modeling Committee reconvened in Fall 2008 to address the OTR states' modeling needs:

- 2008 8-hour ozone NAAQS
- 2006 24-hour PM_{2.5} NAAQS

Initial discussions focused on developing the technical tools to enable **on time** submissions of State Implementation Plan (SIP) attainment demonstrations for ozone and PM_{2.5}.

This includes time for state rule development

OTC SIP Development Approach

- Collaborative approach with other regions and USEPA
 - Base and future year emission inventories
 - Development of meteorology for modeling
 - Development of boundary conditions and international emissions
- Collaborative approach within OTC
 - Sharing resources, coordinating modeling centers
 - Identify and develop control options for inclusion in SIPs
 - Develop model inputs, emission adjustments, and run models
 - Subgroups working on “Transport Analysis” and HEDD

OTC Modeling Platform Development

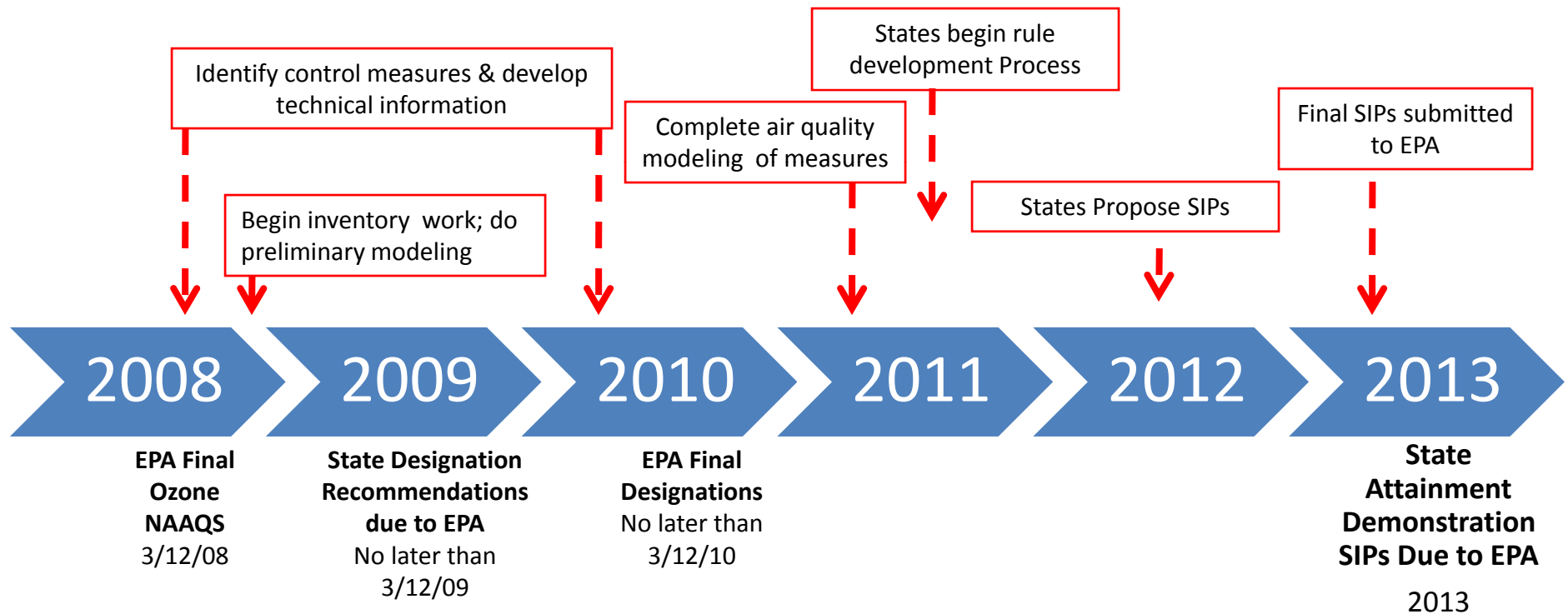


1. Multi-Pollutant Timing Considerations

2008 8-hour ozone NAAQS

- Attainment date for moderate areas expected to be 2nd quarter 2016
- Attainment demonstration SIP due 3 years after final designations or 2nd quarter 2013
- OTC Modeling needs to be complete at least 1 year in advance (2012) to allow for state rule development
- SIP-quality modeling including consideration of control measures must be completed by end of 3rd quarter 2011

1. SIP Timeline for 2008 8-hour O₃ NAAQS



2008 Ozone NAAQS Attainment Dates 2013 - 2030

1. Multi-Pollutant Timing Considerations

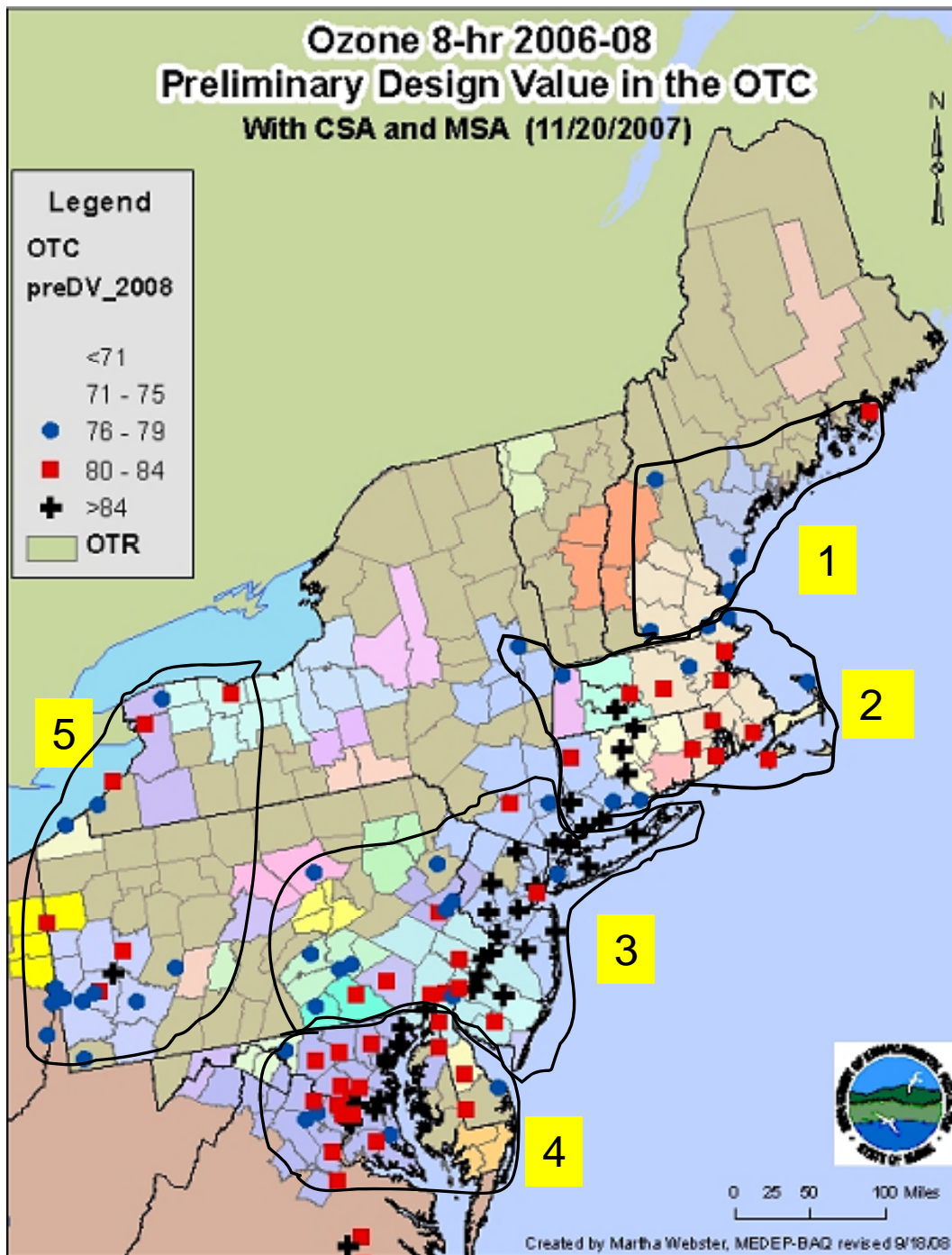
2006 24-hour $PM_{2.5}$ NAAQS

- Attainment date is 2nd quarter 2014
- Attainment demonstration SIP due 2nd quarter 2012
- Modeling needs to be complete at least 1 year in advance (2011) to allow for state rule development
- SIP-quality modeling including consideration of control measures must be completed by end of 2010

2. Base Year Selection

EPA Guidance on selecting episodes

- 1) Simulate a variety of meteorological conditions
- 2) Model time periods in which observed concentrations are close to the appropriate baseline design value
- 3) Model periods for which extensive air quality/meteorological data bases exist.
- 4) Model a sufficient number of days so that the modeled attainment test applied at each monitor violating the NAAQS is based on multiple days.

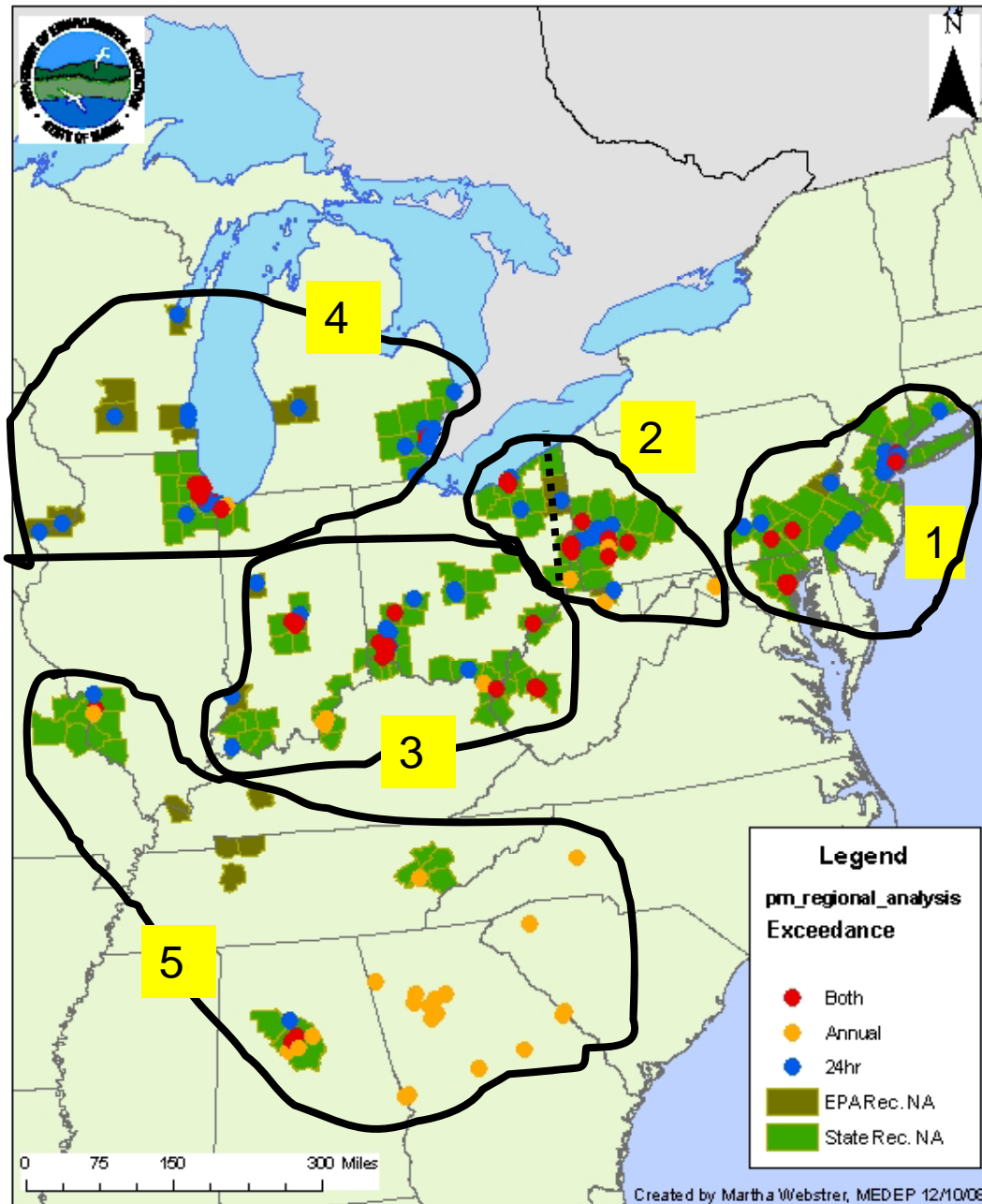


2. Base Year Selection

Ozone data for the years 2002-08 were analyzed for 5 regions in the OTR

1. Northern New England
2. Southern New England and Albany, NY
3. NJ, Southeastern NY and Eastern Pennsylvania
4. Delaware, Maryland, DC and Northern VA
5. Western New York and Western Pennsylvania

Preliminary PM2.5 2005-07 DVs Exceeding Either Standard



2. Base Year Selection

PM2.5 data for the years 2002-08 were analyzed for 5 regions including 2 within the OTR

1. Eastern OTR
2. Western OTR

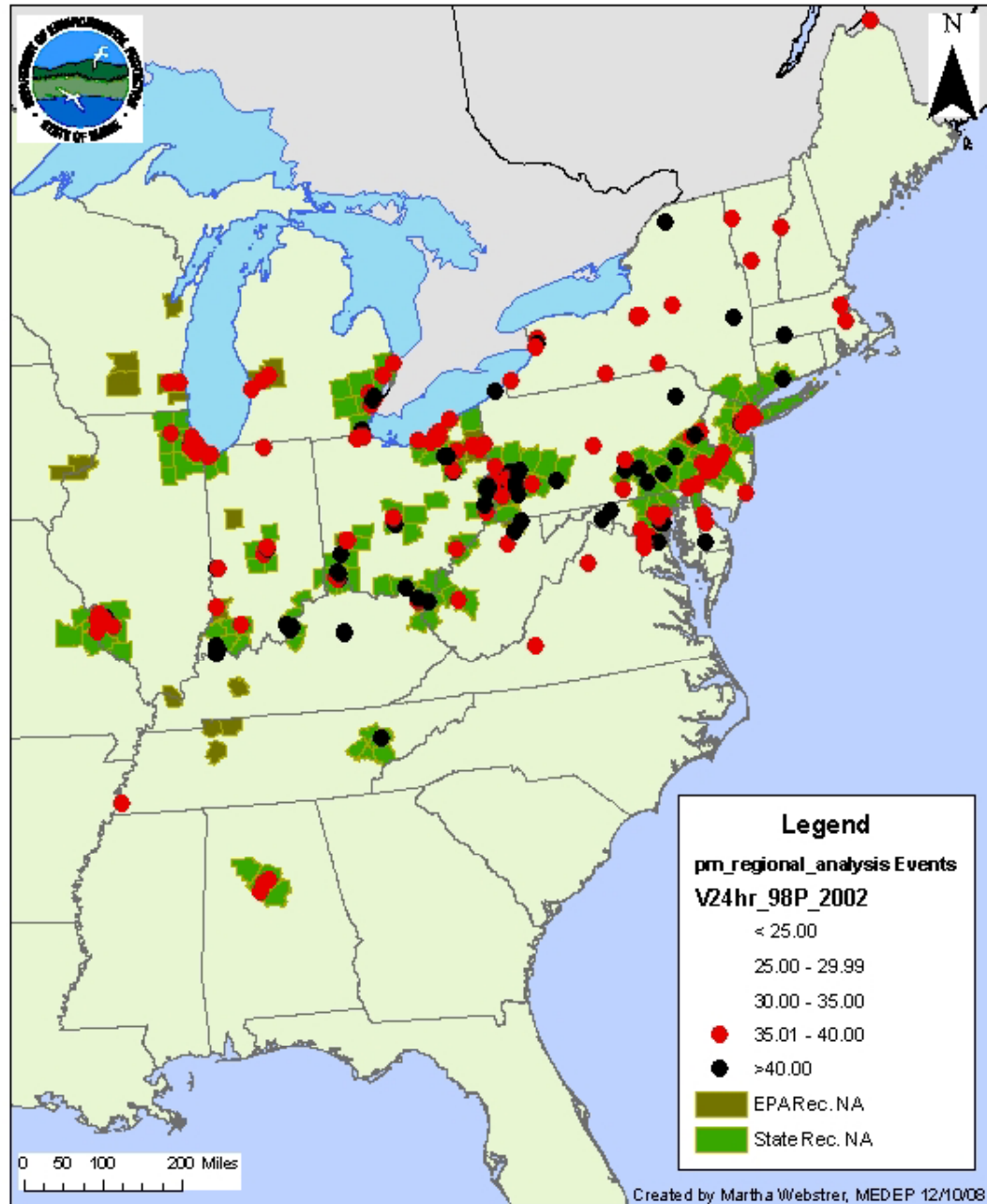
2. Base Year Selection

Overall - 2002, 2005 and 2007 were the best candidate years to model but 2007 was chosen as the single best year to model:

- 2002 was before NO_x SIP Call controls were implemented so observed concentrations were furthest from baseline design values (EPA Guidance item #2)
- 2005 and 2007 equally met EPA Guidance criteria with 2005 being best for the Western OTR and 2007 best for the Northern OTR.
- 2007 is closer to the periodic inventory year of 2008 and, from a modeling point of view, it's easier to back-cast the emissions to 2007 from 2008 than to go to 2005

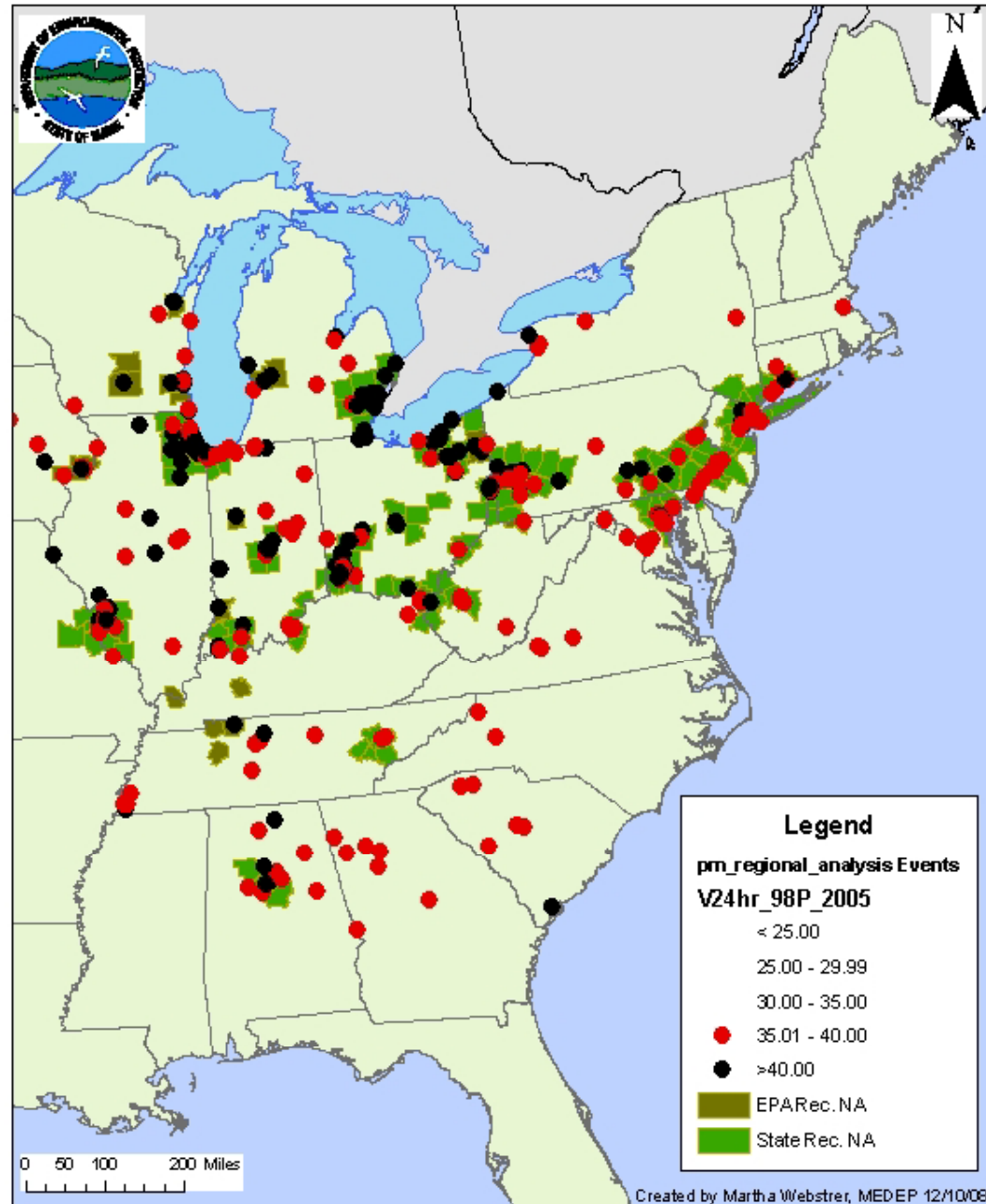
98th percentile
24-hr PM2.5
Concentration
Maps for 2002
and 2005
Inventory Years
and 2007

2002 PM2.5 24hr 98th Percentile



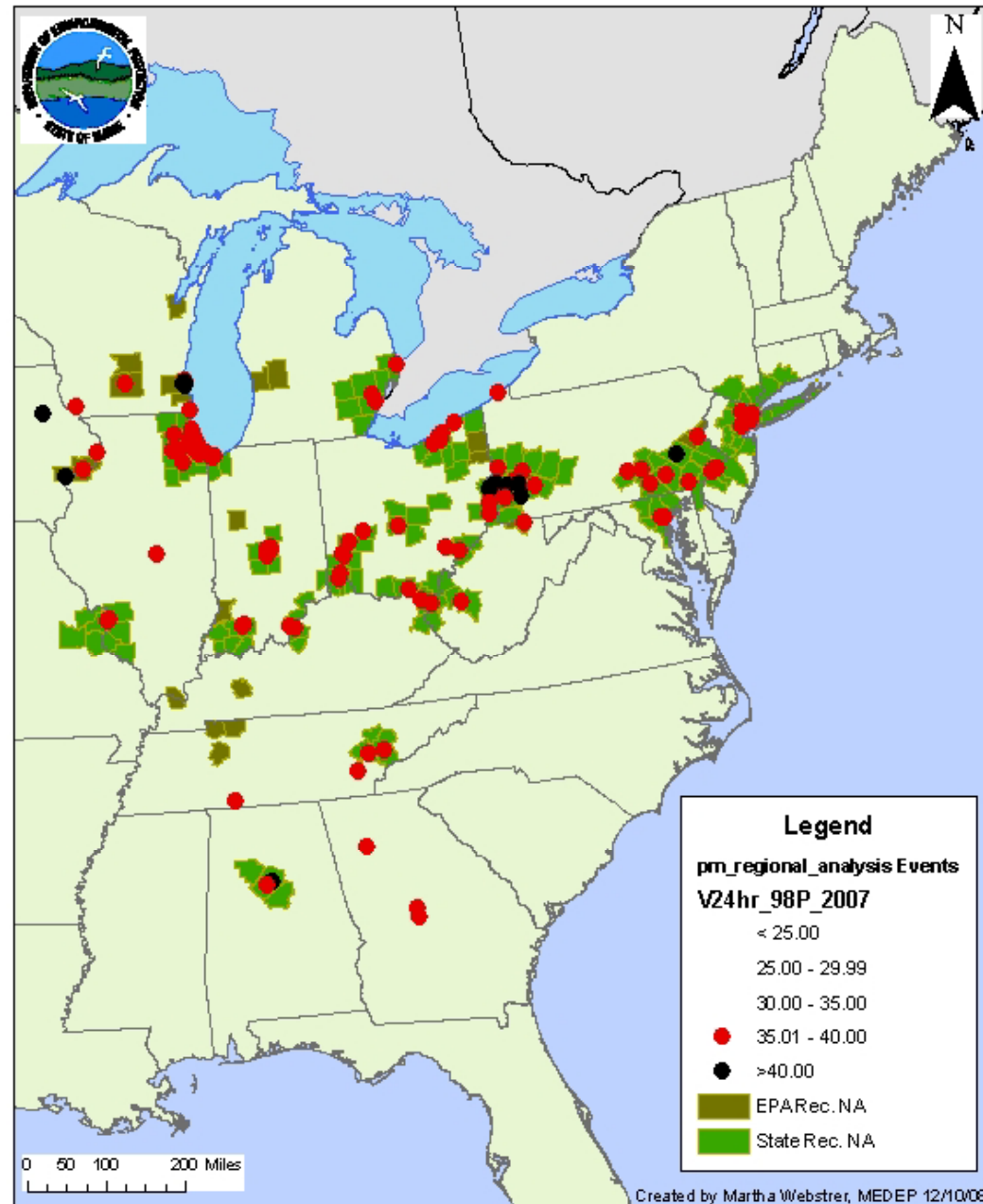
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2005 PM2.5 24hr 98th Percentile



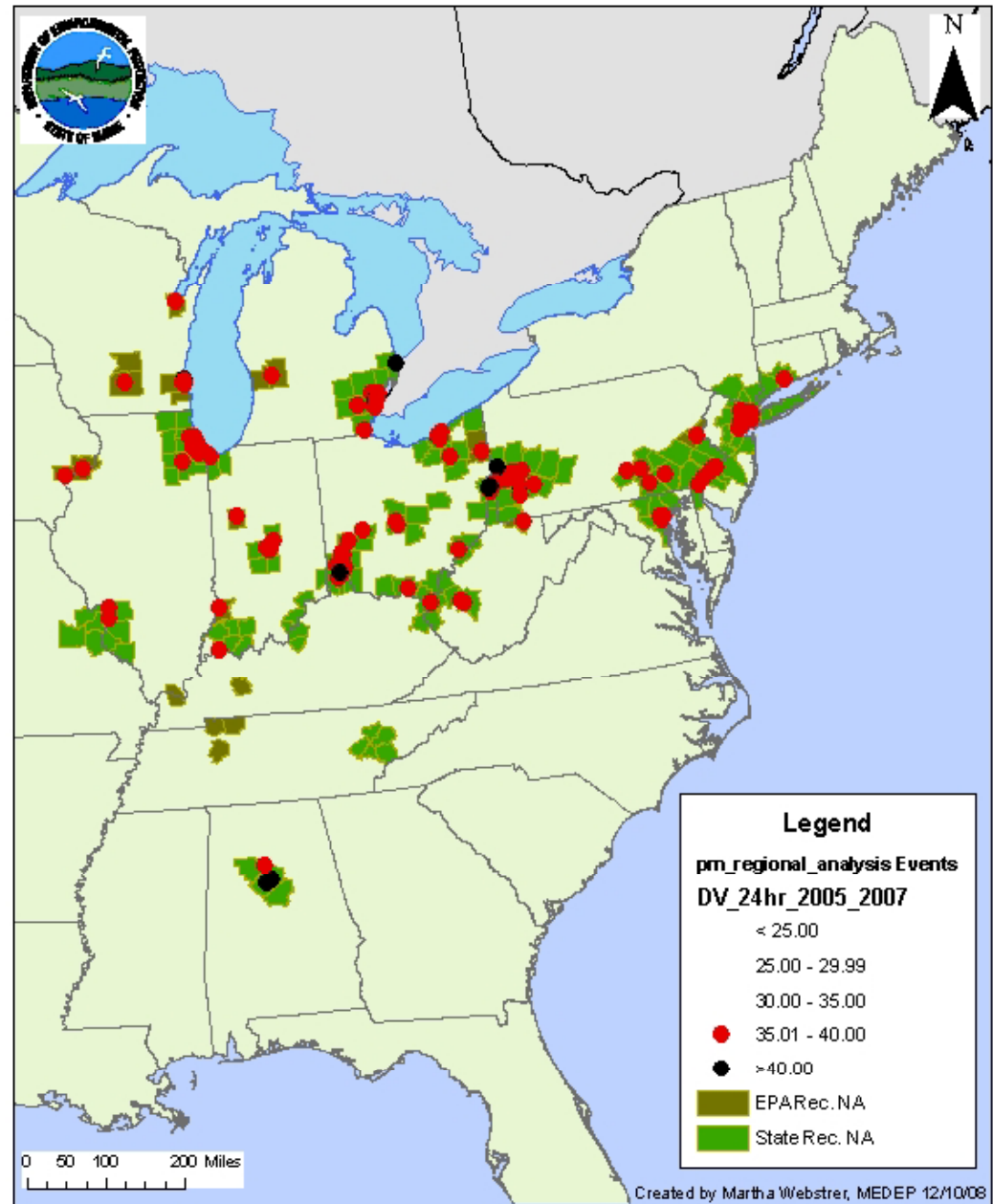
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2007 PM2.5 24hr 98th Percentile



Preliminary
2005-07 24-hr
PM_{2.5} NAAQS
DESIGN VALUE
Nonattainment
Site Map

Preliminary PM_{2.5} 24hr 2005-07 Design Value



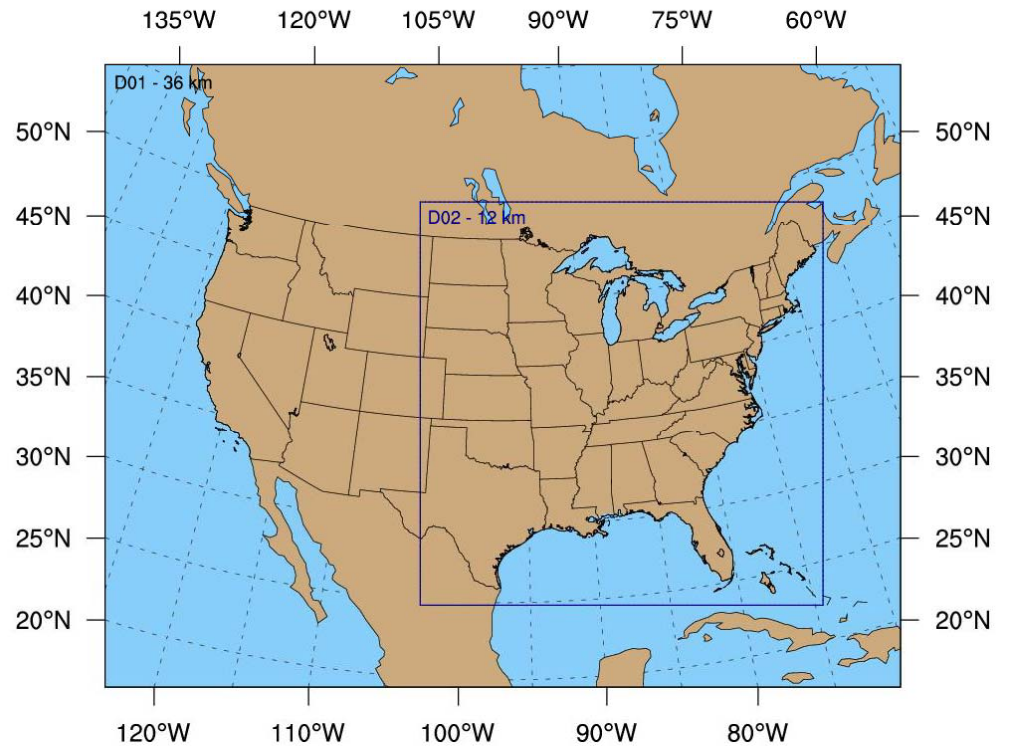
3a. Meteorology Development

- Collaborative effort between OTC States and other organizations with meteorological modeling expertise
 - includes University of MD and States of GA, IA, KS, MD, NC, NH, NY, and VA
- Weather Research and Forecasting (WRF) model selected for use in upcoming SIP modeling
 - considered the most advanced public-domain model for preparing weather data inputs to urban- and regional-scale photochemical air quality models
 - use of WRF supported by EPA

3a. Meteorology Development

WRF modeling protocol

- Draft developed July 2009
- Work now underway
- 2007 annual model simulation with possible additional year (2008)
- 36-km horizontal resolution North American domain with nested:
 - 12-km domain covering the LADCO, OTC/MANE-VU and SESARM regions



3a. Meteorology Development

WRF modeling protocol (continued)

- performance benchmark runs conducted by each modeling center
- sensitivity simulations (e.g., PBL and cloud physics) to optimize model configuration
- model performance evaluation to be conducted by modeling centers with support from SESARM contractor
- delivery of WRF outputs for subsequent use in air quality modeling no later than January 1, 2010
- documentation of the meteorological modeling study findings to be available for public review via FTP or website.

3b. Emissions Inventory Overview

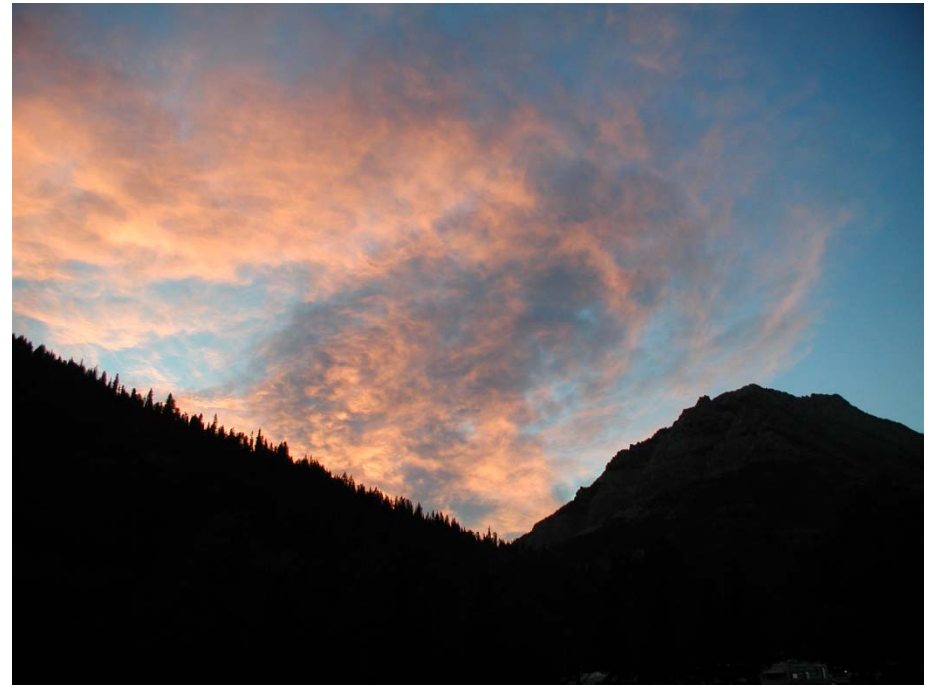
- Base Year: 2007
- Three Future Years: 2013, 2015, 2018
 - Pending discussions with EPA
 - Ozone, PM2.5, and Visibility target dates
- Stakeholder review of 2007 point and nonroad data
 - Planned for October 2009
- More details tomorrow



4. OTC Modeling Approach

Overview of past OTC Modeling and current approaches for SIPs

This is a product of OTC Modeling committee, with the goal being to adhere to the timelines established by the OTC Commission



4. OTC Modeling Approach

Prior OTC Modeling work

Anthropogenic Emissions Developed through MANE-VU/MARAMA for Base year 2002 and Future years 2009, 2012, and 2018

- Utilized SMOKE v2.1 emission inventory model
- Base 2002 EGU emissions adapted from EPA/CAMD
- Projected 2009, 2012, and 2012 EGU based on Inter-RPO IPM simulations
- On road emissions based on Mobile 6.2
- Off road emissions based on EPA Non-Road
- Canadian emissions (2002 point, 2000 other categories)
- Biogenic emissions based on BEIS 3.12

4. OTC Modeling Approach

Prior OTC Modeling work

- Meteorology - MM5 with MCIP v3.1
- IC/BC - Based on GEOSCHEM at 36km and CMAQ at 12km
- Photochemical Model – CMAQ v4.5.1 with CB4 chemistry
- Simulation periods – Annual 2002, 2009
 - Summer 2012, and
 - Annual 2018

4. OTC Modeling Approach

Planned OTC SIP Quality Modeling work

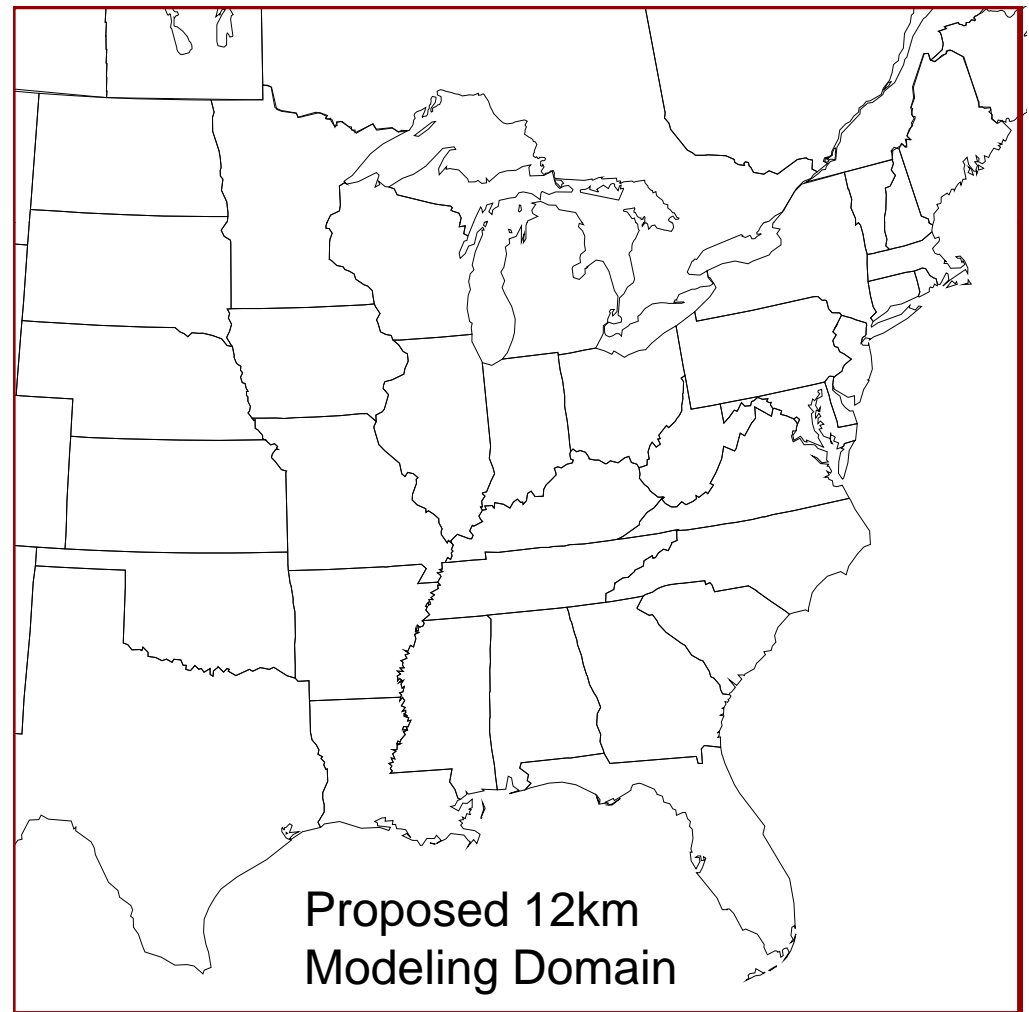
Anthropogenic Emissions Developed through MANE-VU/MARAMA for Base year 2007 and Tentative Future years 2013, 2015, and 2018

- Will model ozone and PM2.5 with same model platform
- Base Year 2007
- Utilize SMOKE v2.5
- 2007 EGU emissions from EPA/CAMD
- Future year EGU emission projections yet to determine
- On road emissions to be based on MOVES or Mobile 6.2
- Off road emissions based on EPA Non-ROAD
- Canadian emissions based on 2005/2006
- Biogenic emissions based on BEIS 3.14 or MEGAN (Model of emissions of gases and aerosols from nature)

4. OTC Modeling Approach

Planned OTC SIP Quality Modeling work

- Meteorology
 - WRF with MCIP v3.4
- IC/BC - under discussion
- Photochemical Model
 - CMAQ v4.7 with CB05 Chemistry
- Simulation periods
 - Annual 2007
 - Future years yet to be determined



4. OTC Modeling Approach

Screening Modeling

- Provides a “ballpark” estimate of the reductions that will be needed for attainment
- Allows for the longer term development of the SIP-quality modeling platform
- 2005 emissions and 2002 meteorology will be used
- New chemistry and biogenics modules will be tested
- Percent emission reductions by source categories reflecting “bundles” of controls (Ozone and PM)

4. OTC Modeling Approach

SIP Quality Modeling

- 2007 as both the base modeling and meteorology year
- Decision on appropriate future years for projecting growth and for control measure implementation
- Timely release of EPA guidance on using the new mobile emissions model -MOVES- to maintain our SIP modeling timeline

5. Planned Screening and Sensitivity Simulations

- The intent of these simulations is to get a better understanding of the changes between the 2002 and 2007 modeling frameworks
- Change in chemistry module from CB4 to CB05
- Change in Biogenic emissions processor
BEIS 3.12 vs BEIS 3.14 vs MEGAN
- Response of the modeling system to emissions reductions

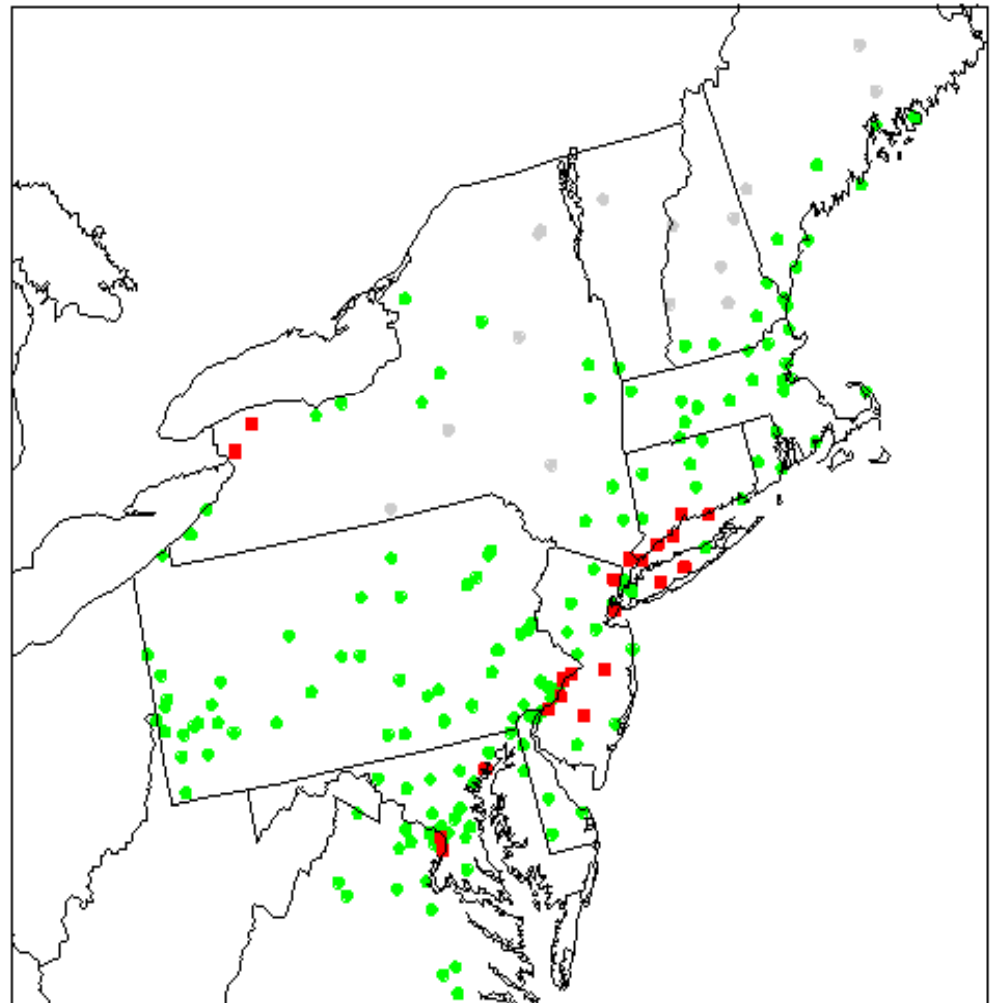
5. Planned Screening and Sensitivity Simulations

- Expected completion by December '09
- Response to different Biogenics processors
- Response to changes in Chemistry module
- Modeling framework consists of
 - use of 2002 meteorology
 - interpolated 2005 emissions
 - processed with CB05 chemistry

6. Previously Completed Screening and Sensitivity Simulations (with 2002 Ozone Modeling Platform)

The previously performed 2018 modeling results help us start answering the questions “How much do we have to do, and where are our problem areas?”

- Beyond-on-the-way regional measures from a 2002 base
- Includes benefits from the CAIR



● ≤ 75 ppb

■ > 75 ppb

● No RRF Available

6. Previously Completed Screening and Sensitivity Simulations (with 2002 Ozone Modeling Platform)

Screening Modeling

- NY DEC did a screening modeling run, reflecting a 40% NO_x reduction from all sectors domain-wide
- Results showed all sites below 75ppb, but some just barely
- Other states east of the Mississippi River were assumed to make commensurate NO_x reductions
- Additional screening modeling with packets of control measures early in 2010

6. Previously Completed Screening and Sensitivity Simulations (with 2002 Ozone Modeling Platform)

Ball-park - hypothetical 40% Reduction Run

Purpose:

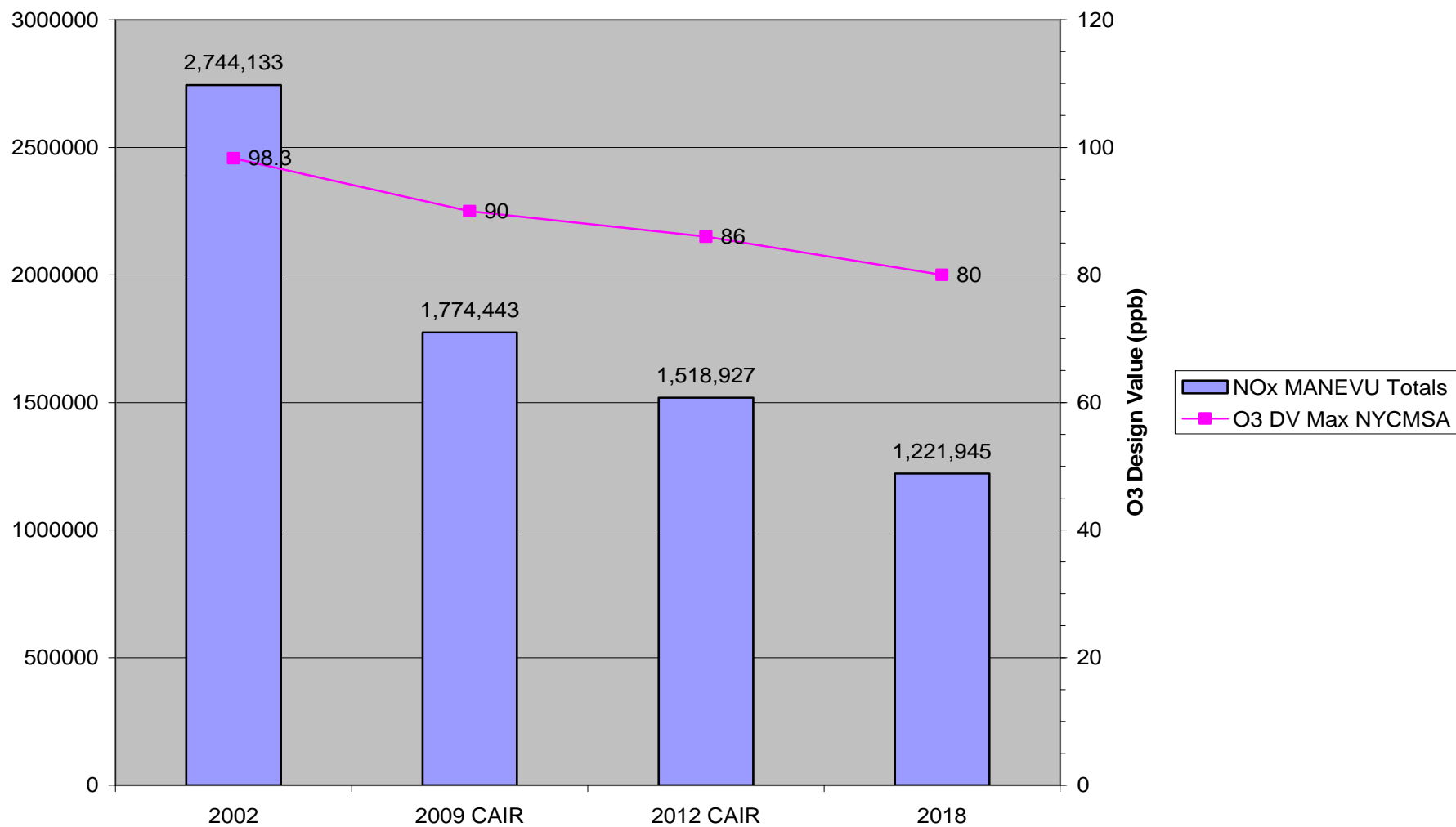
- To establish the general level of emissions reduction needed to achieve the new 8-hr ozone NAAQS of 75 ppb

How:

- Tested only one option, but several others in combination with other precursors are viable and need assessment
- Selected a scenario with 40% reduction in NO_x emissions across the domain off of 2012 projected emissions
- Selected future year (2012) as an example, other year(s) could have been selected

6. Previously Completed Screening and Sensitivity Simulations (with 2002 Ozone Modeling Platform)

Annual NO_x Emissions and highest 8-hr ozone design value
in the New York CMSA (hypothetical 40% Scenario)



6. Previously Completed Screening and Sensitivity Simulations (with 2002 Ozone Modeling Platform)

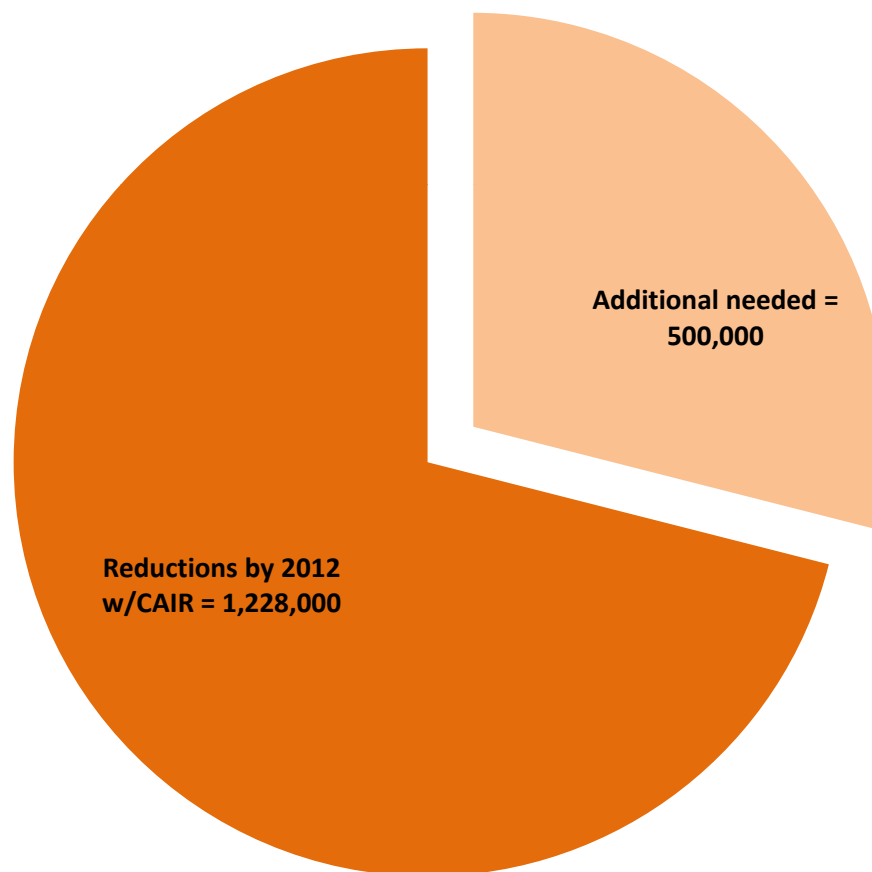
OTR States Projected to Exceed New 8-hr Ozone NAAQS
Based on 2012 projected emissions
(hypothetical 40% Scenario)

State	Exceeding 75 ppb No-CAIR	Exceeding 75 ppb w40% NOx reduction
CT	YES	NO
DE	YES	NO
DC	YES	NO
ME	NO	NO
MD	YES	NO
MA	YES	NO
NH	NO	NO
NJ	YES	NO
NY	YES	NO
PA	YES	NO
RI	YES	NO
VT	NO	NO
VA	YES	NO

6. Previously Completed Screening and Sensitivity Simulations (with 2002 Ozone Modeling Platform)

The OTR's share of the hypothetical 40% reduction
is on the order of 500,000 tons of NO_x

Total NO_x
reductions needed
in the OTR from a
2002 base =
1,728,000 tons



*Additional reductions also needed in Midwest & Southeast regions

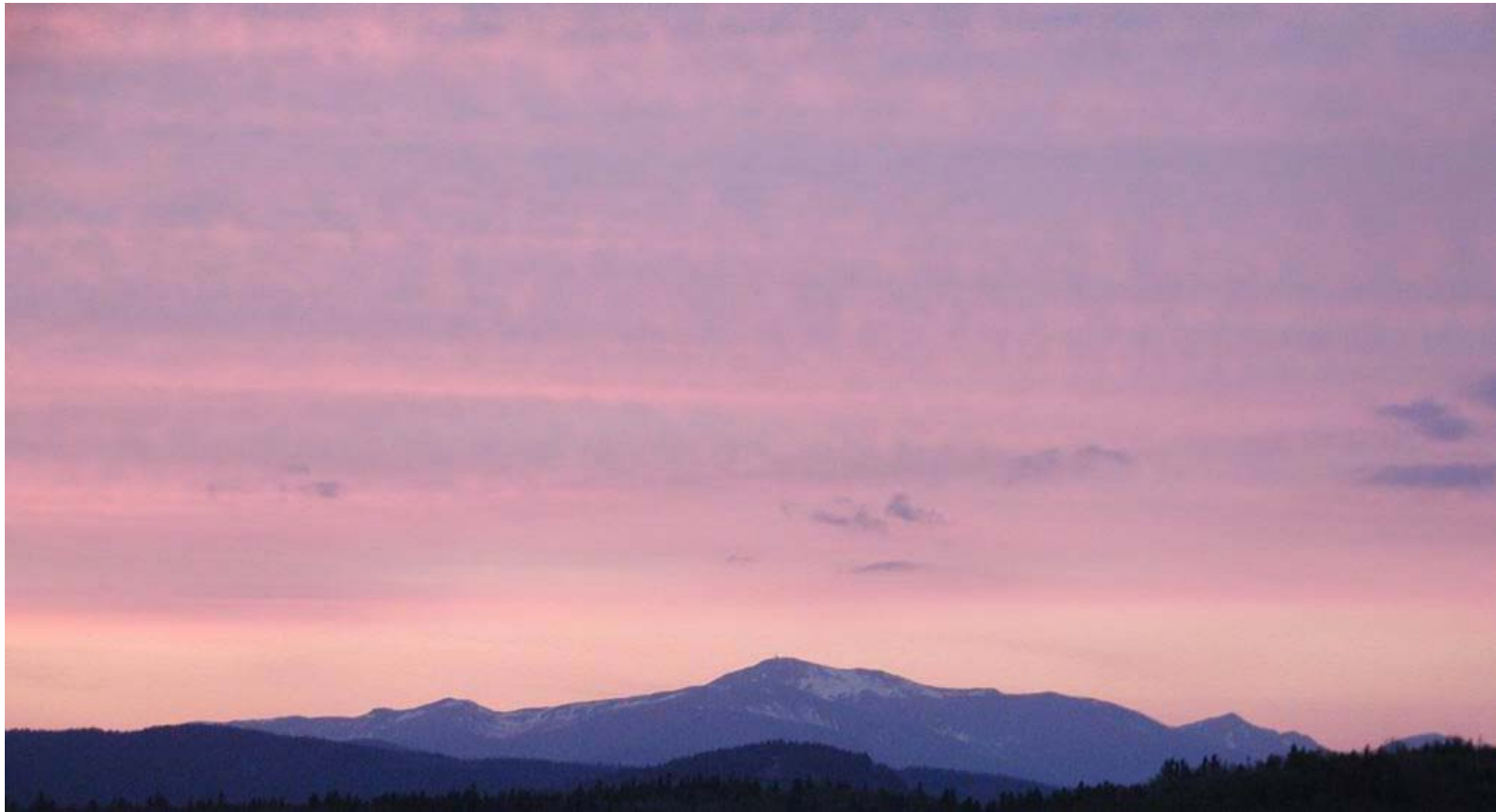
6. Previously Completed Screening and Sensitivity Simulations (with 2002 Ozone Modeling Platform)

New Jersey Screening work

Explored sensitivities to:

- Performance Standards on EGU
- ICI Boiler RACT Controls
- Storage Tank VOC Containment Improvements
- On-road Mobile Adjustments

Summary



Day 2 Presentations

- High Electric Demand Day (HEDD) Work
- Modeled Transport Assessment Work