

*Development of 2011 Modeling
Platform and Early Release of
Emissions Inventories*

Briefing for RPOs/States

August 15, 2013

Briefing Outline

- 2011 Modeling Platform
 - Purpose and construct of 2011-Based Platform
 - Rationale for choosing 2011
 - Components of Platform
 - Plans for evaluation
 - Timing
- Early data release of non-EGU and EGU emissions

2011 Modeling Platform

Purpose of the 2011 Platform

- Purpose of the Platform
 - to provide a comprehensive modeling platform that is based on the most recent technically sound and representative data and state-of-science tools available for use in air quality model applications to support EPA regulations and policy-related analyses.

Construct of Modeling Platform

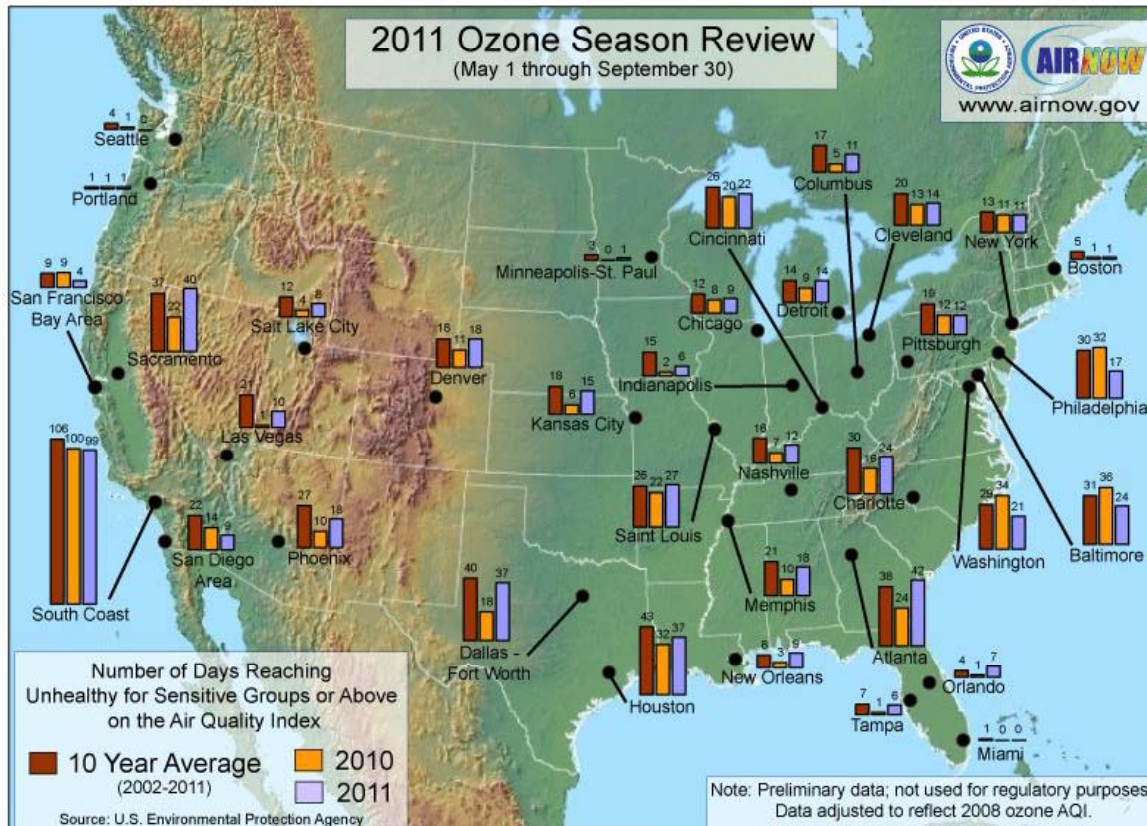
- Components of modeling platform are, by their very nature, “evolutionary” and not static
 - Emissions, meteorological, and air quality models are updated by developers on a semi-regular basis; though not necessarily in sync with the timing of our rules.
 - Emissions inventories are subject to updates and project-specific adjustments and refinements
- It is inevitable that there will be updated data and tools integrated into the platform over time
 - Improves credibility of platform over time

Basis for Focusing on 2011

- Factors considered in choosing base year
 - Availability of year-specific emissions data
 - Ability to use recent ambient data in design value projections
 - Avoid years that are not conducive/representative for the formation of ozone and PM_{2.5} species concentrations
- 2011 was selected because.....
 - We can utilize/leverage the 2011 NEI
 - Meteorology in summer of 2011 was not extreme in terms of being overly conducive or unconducive to photochemistry

Ozone in 2011

(Days with ozone exceedances, relative to 10-year averages, for select areas)



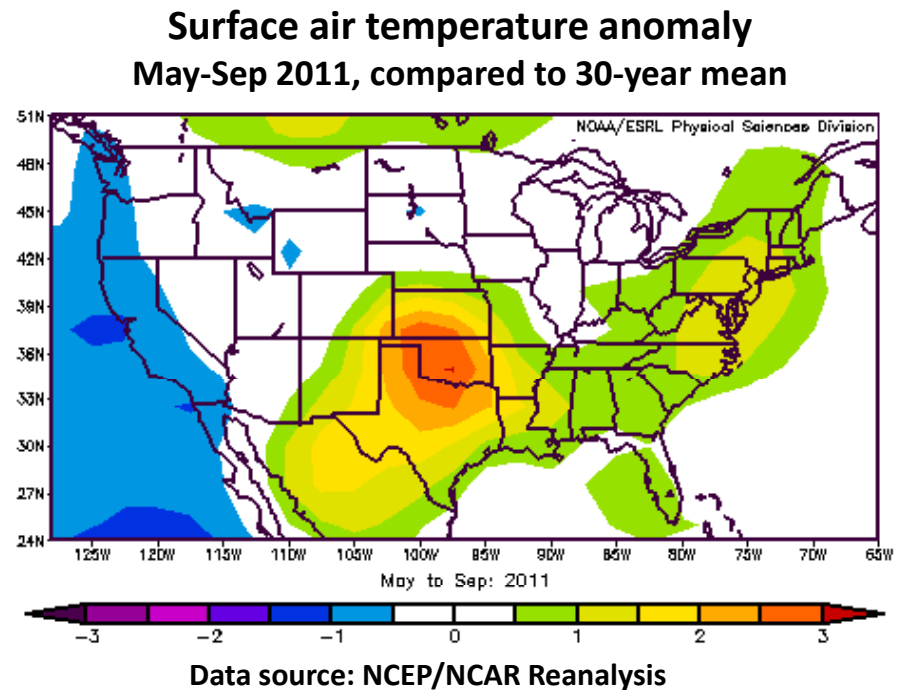
- While ozone trends have shown improvement over the past decade, the 2011 exceedance counts are similar to the long-term averages in many locations.
- EPA analyses suggest that the 2011 meteorology was slightly more conducive to ozone formation than average.

<http://www.epa.gov/airtrends/weather.html>

Meteorology in Summer 2011

- Meteorological patterns can be highly variable across years.
 - No single year will be perfectly “representative”
- The 2011 warm season meteorology featured:
 - A stronger than normal upper air ridge over the central U.S.
 - This ridge led to warmer than normal temperatures over parts of the eastern/southern U.S.
 - There was also less rainfall than normal over those same regions
- While warmer than usual, 2011 temperatures are consistent with other recent summers in the U.S.
 - 2006, 2007, 2010, 2011, & 2012 are all among the ten warmest on record

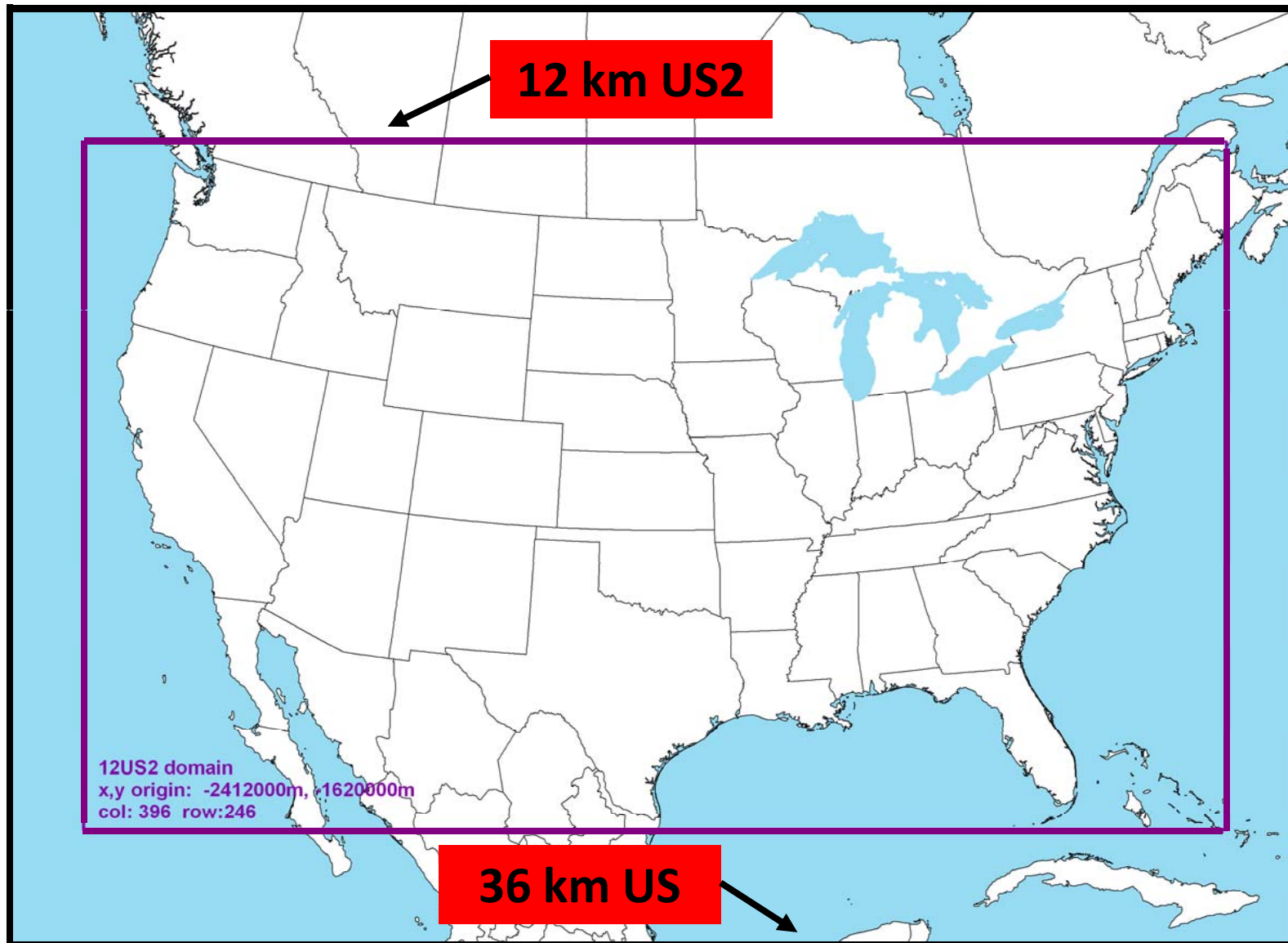
<http://www.ncdc.noaa.gov/cag/>



Components of the Platform

- Modeling Domain
- Non-Emissions Components
 - Air quality models, meteorology, boundary concentrations
- Emissions Components
 - 2011 base year emissions, emissions projections, emissions modeling

National 12 km Modeling Domain & Parent 36 km Domain



Non-Emission Components of Platform

- Air Quality Models
 - CMAQ v5.01
 - CAMx v6.0
- Meteorological Models and Pre-processors
 - WRF v3.4
 - MCIP v4.1.3
 - wrfcamx v4.0
- Vertical Resolution
 - 25 layer structure
- Initial and Boundary Concentrations
 - 2011 GEOSChem global simulation

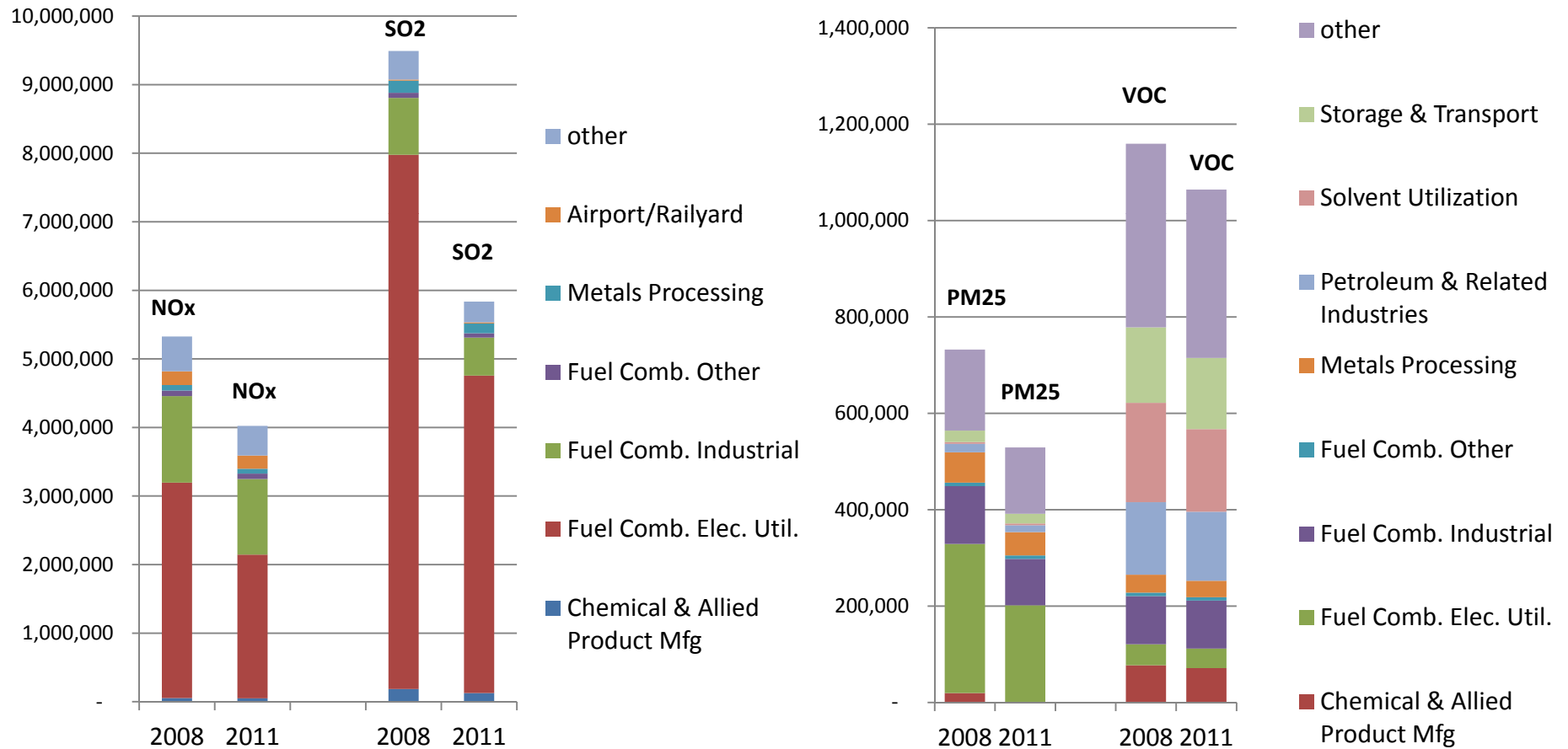
2011 National Emissions Inventory

- Primarily relies on state-submitted data, augmented with EPA data
- Version 1 schedule:
 - July 2013: Point and Events available in EIS
 - August/Sept 2013: Nonroad, Nonpoint, Onroad in EIS plus flat files for modeling
 - Late September 2013 - Public (website) release
 - Fall 2013 – Draft documentation

EPA Emissions Datasets

- Electric Generating Unit data from Clean Air Markets Division, Mercury and Air Toxics Standards
- Augmentation datasets for missing PM species, HAPs
- Chromium Speciation
- Toxic Release Inventory (TRI)
- Locomotives and commercial marine
- Airports (aircraft, ground support, auxiliary power units)
- Landfills
- Numerous nonpoint categories
- Oil and gas via EPA oil and gas tool (new for 2011)
- Events: prescribed and wildfires
- Onroad and nonroad emissions
- Biogenic emissions from BEIS v3.14
- Offshore platforms (carried forward from 2008)
- Other --NV goldmines (carried forward from 2008)

Point Inventory for Criteria Pollutants 2011 vs 2008 NEI



Example EPA Nonpoint Categories

- Data/tools posted on planning page
- Used to gap fill where states do not submit data
- Agricultural Fertilizer
 - CMU Ammonia Model v3.6, adjusted fertilizer activity using 2010 data (2002 is the base year for the CMU model)
- Agricultural Livestock waste
 - 2008 pulled forward without adjustment.
 - 2008 emissions from CMU Ammonia Model Version 3.6 and adjusting for changes in animal population using the 2007 Census of Agriculture
- Residential Wood Combustion
 - Improved emissions estimates via Eastern Regional Technical Advisory Committee (ERTAC) Project, includes transparent review of appliance counts, burn rates and emission factors
 - Grown from 2008 based on more recent data, 2008 method presented in NEI conf paper (<http://www.epa.gov/ttn/chief/conference/ei17/session2/huntley.pdf>)

NEI v1 Mobile Emissions

- Onroad
 - First time MOVES activity data/inputs obtained directly from states
 - Using SMOKE-MOVES to generate NEI for all but CA and TX
 - MOVES county databases (CDBs) received from more than 30 agencies
 - EMFAC-based emissions for California (per their submittal)
- Nonroad
 - Using NMIM (NONROAD) with inputs collected from the states
 - NMIM county databases (NCDs) received from more than 12 agencies
 - Using California and Texas-submitted emissions

NEI v1 Commercial Marine Vehicle Emissions

- Category 1 and 2 Small/medium diesel vessels, known as C1/C2
 - NEI will have blend of EPA (top-down) & state data
 - States had to submit emissions at shape level for counties that had them
 - Working on improving spatial allocation method for EPA data
 - 2011 includes emissions in Gulf for support vessels
- Category 3 (big ships) - C3 CMV
 - Blend EPA and state data
 - EPA data based on EPA's ECA-IMO inventory- rule development inventory (Emission Control Area -International Maritime Organization)

Emissions Modeling

- Overview -

- Emissions modeling converts annual (or monthly) point- or county-based inventories into hourly emissions by model grid cell, in a format the air quality model can use
- SMOKE is the emissions model used by EPA:
<http://smoke-model.org>
- EPA posts emissions platform data, once available, on the CHIEF Emissions Modeling Clearinghouse
 - <http://www.epa.gov/ttn/chief/emch>
 - Includes inventory and some activity data
 - Ancillary data for speciation and spatial and temporal allocation

Onroad Emissions

- SMOKE-MOVES integration being used
- Using state inputs for activity but not fuels
- Developing temporal profiles based on state inputs
- Benefits of SMOKE-MOVES
 - Provides hourly, speciated, gridded emissions for the AQM
 - Takes advantage of hourly meteorological changes and sub-county variability (especially important for PM + VOC)
 - Provides greater transparency between MOVES and emissions modeling (e.g., exposed activity data)
 - Allows NEI to be consistent with regulatory runs
 - Computational advantages via the use of representative counties and “cloud” computing

Spatial Surrogates

- Use circa 2010 data (census, FEMA, NTAD 2011)
- Oil and gas surrogate updates for sources in the Northeast and western US
- Commercial Marine Vessel surrogate improvements in Great Lakes and Gulf of Mexico

Other Key Emissions Modeling Features

- Met-based temporalization used for fertilizer NH₃ and RWC
- Temporal allocation being updated for EGUs and onroad
- A recently-developed fire-averaging tool and methodology is available
 - Leverages available 2007-2011 SMARTFIRE2-based point daily fires
- Speciation
 - Using SPECIATE database, Version 4.3
 - Speciation Tool creates profiles for CMAQ 5.0, CAMx
 - Speciation Tool just publically released via CMAS!
- Fugitive dust transport fractions approach takes land use and soil moisture into account (Pouliot)

Plans for Model Evaluation

- Meteorological model evaluation
 - Temperature, mixing ratio (moisture), precipitation amount, wind speed and direction at the surface and aloft
- Air quality model evaluation
 - Ozone and PM2.5 component species
- Statistical and graphical comparisons
 - Bias and error stats
 - Time series of predictions and observations
 - Box plots of the distribution of predictions and observations

Timing

- We expect to perform the annual 2011 CMAQ and CAMx model runs in the next two months
- Performance evaluation will begin following the completion of the model simulations with results by spring 2014

Early Data Release of Non-EGU and EGU Emissions

Background on Emissions Sharing

- Sharing emissions data early in the process:
 - Gives additional time to review and comment prior to final rule emissions modeling
 - Gives EPA more time to incorporate comments for the final rule
- Using 2011 base and 2018 future year inventories for proposal emissions modeling
 - 2011 largely based on 2011 National Emissions Inventory (NEI) data
- We have incorporated many state and RPO comments during 2013
- Rule proposal will explain how we intend to address comments received but not incorporated

Plan for Non-EGU Data Sharing

- 2011 data release – plan to complete by October
 - Some 2011 NEI data and emissions modeling-formatted inventories available now in the Emissions Inventory System (EIS) and EPA CHIEF website
 - Working on how best to get inventory comments into EIS/NEI *and* emissions modeling inputs (would like to maintain consistency)
 - Coordinating with expected 2011 NATA point source HAP review this fall
- 2018 data – plan to complete by end of 2013, November is goal
- Approach for providing comments will be clearly defined when data are formally released for comment
- We would like state/RPO feedback on what emissions data and summaries are of interest

Background on EPA's Power Sector Modeling

- EPA uses the Integrated Planning Model (IPM) to obtain EGU emission projections for baseline and policy modeling
- IPM is a long-term capacity expansion and production costing model for analyzing the U.S. electric power sector
- IPM finds the least-cost solution to meeting electricity and steam demand subject to environmental, transmission, fuel, reserve margin, and other system operating constraints
 - We use IPM to analyze emissions policies affecting the power sector that achieve environmental goals at the lowest possible cost to society
 - EPA uses IPM projections as EGU inputs in our air quality models
 - EPA has adapted the model to reflect new economic and environmental policy developments over time

EGU Data Sharing

- Working on a new IPM platform (v.5.13) that has significant updates compared to the previous version (v.4.10)
 - Improved regional resolution (64 instead of 32 regions) and updated representation of coal and gas supplies
 - 2018 unit level projections and air quality-ready files will be available in September to feed into the air quality model
 - Also working on improving allocation to hourly emissions, which needs to be consistent for the 2011 inventory and 2018 projections
- Held IPM workshop May 2 and continue to engage stakeholders on interests identified
- Draft NEEDS v.5.13 database made available for public comment in May
 - Roughly 100 commenters, including 23 state environmental agencies, submitted input that will be incorporated as time allows throughout our process

EGU Projections Sharing

- Planning to make the latest IPM projections available to states and stakeholders for input in October
- Working to coordinate the outreach on EGU data and projections with outreach on the 2011 and 2018 emissions data
- May not be able to incorporate all input prior to the transport rule proposal, but will work to include adjustments as the schedule allows and to prepare for full incorporation in the final rule's modeling
- Also working with states to share data and review projections from multiple tools for SIP compliance/demonstrations
 - Engaged with Regional efforts on the NE MARKAL model and ERTAC tool
 - Unit-level input files have been “cross-walked” as part of the ongoing collaborative process for informing EPA’s EGU projections
 - Will compare projections from resources like IPM v.5.13 and ERTAC in the future as they are made available