

2008 National Emissions Inventory and Associated Modeling Platforms

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Modeling Workshop

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Overview

- 2008 NEI
 - Status
 - Data highlights
 - 2008 NEI process to date
 - Caveats (missing sectors, known issues, etc.)
- 2008 NEI improvement plans
- 2008-based Modeling Platforms
 - Plans and timing
 - Working with outside partners
- Collaboration and next steps

2008 NEI Status

- 2008 NEI version 1.5 released (5/16/2011)
- First inventory that has used the Emission Inventory System (EIS)
- 2008 NEI v1.5 primarily relies on state-submitted data, but augments with EPA data in some cases:
 - EGU data from CAMD
 - Augmentation datasets for PM_{2.5}, HAPs, and zero-outs of outlier values
 - Locomotives and commercial marine
 - “Selection hierarchy” documentation available
- Review and improvements planned throughout 2011 and into 2012

2008 Data Availability

- 2008 NEI & documentation available from <http://www.epa.gov/ttn/chief/net/2008inventory.html>
- There is a new NEI Browser available for tabular data and Where You Live provides maps
- Modeling data available in new “Flat File 2010” (FF10) format used for EIS-based inventories
 - SMOKE ORL point and nonpoint format files are available now, others coming soon
 - ORL needed until SMOKE can read FF10
 - Check here for the latest data:
<http://www.epa.gov/ttn/chief/emch/index.html#2008>

2008 NEI Quality Assurance

Quality Assurance Check	Status
EIS Automated QA checks of codes and data integrity	Done*
Point source completeness check comparing to 2005 NEI	Done*
PM _{2.5} review and augmentation	Done*
Identification and zero-out of highly suspect HAP emissions	Done*
HAP augmentation	Done* (not Hg)
Mercury emissions augmentation	In progress
Lat-lon comparison to county boundaries	Sent 6/24, due 7/22
Control code analysis and updates	Sent 8/1, due 9/2
Comparison to 2005 CAP modeling platform emissions	In progress
Comparison to 2005 NATA HAP emissions for high-risk facilities	Sent 9/30, due 10/31
Ozone & PM air quality modeling “shakeout”	Pending

* “Done” w/ regards to V1.5. Some may be redone in future versions (e.g., EIS checks and PM augmentation)

2008 NEI v1.5 Key Caveats

(Criteria pollutants)

- Onroad mobile emissions from MOBILE6 rather than MOVES
- Missing sources:
 - South Dakota did not report point sources
 - Wildfires and prescribed burning (ag fires only included if state-submitted as nonpoint)
 - No landfills
 - Some key western nonpoint categories not filled in by EPA
 - Agricultural tilling (update for v2 in progress)
 - Mining and quarrying (update for v2 in progress)
 - See Eastern Research Technical Advisory Committee (ERTAC)-based workbook:
http://www.epa.gov/ttn/chief/net/nei08_nonpoint_data_popup.html
- California lat-lons: 1441 facilities outside county boundaries and 1001 facilities at the same lat-lon
- For more details, see
http://www.epa.gov/ttn/chief/net/2008nei_v1/v1_5_issues.xls

2008 NEI v1.5 Aircraft, Locomotives and CMV

- Airports
 - All known airports (~20K) now inventoried, little overall increase (mostly small GA), all as point sources
 - Now also includes ground support equipment and APUs (also as point sources)
- Rail*
 - Worked with the Eastern Regional Technical Advisory Counsel (ERTAC) and rail trade organizations to improve emissions estimates
 - 2008 EPA/ERTAC estimates allocated to shape files representing track miles that are also associated with counties
 - Rail yards added in 2008 as point sources
- CMV*
 - Emissions estimation techniques mostly unchanged; however...
 - Now allocated to line shapes for underway, polygons for ports, and off shore polygons for areas beyond the state waters.

* EIS software was unable to successfully merge county-level emissions submitted by agencies EPA shape file estimates. We are working to correct this in future versions but in v1.5, only EPA data used in the selection.

Select Nonpoint Submittals

Res. Wood Combust.		CA	CO	ID	KS	OR	UT			Clarke	Maricopa	Washoe
Ag Tilling	AZ	CA			KS				ABQ		Maricopa	
Animal Husbandry	AZ	CA		ID	KS		UT		ABQ		Maricopa	
Fertilizer Application	AZ	CA			KS			WA			Maricopa	
Paved Road	AZ	CA	CO	ID	KS			WA			Maricopa	Washoe
Unpaved Road	AZ	CA	CO		KS		UT	WA				Washoe
Construction Dust	AZ	CA		ID	KS		UT				Maricopa	Washoe

-Numerous tribal submittals not shown: see Appendix

-Western States with no submittals for these sources: MT, NE, NM, NV, ND, OK, SD, TX, WY

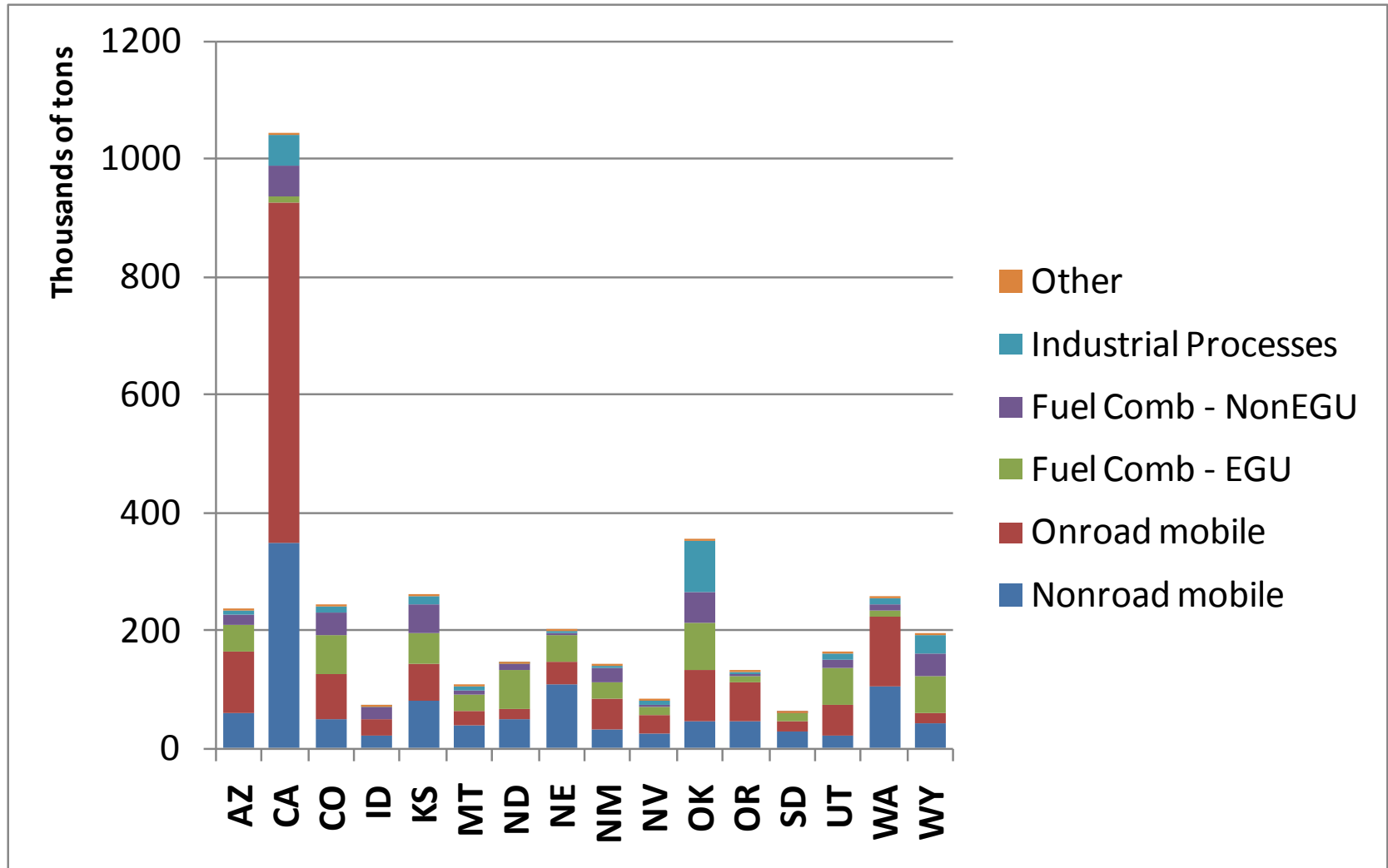
**** EPA estimates used when no state/local/tribe submittals for *most* nonpoint categories;**

exceptions to this include ag tilling and many other categories not listed here (see previous slide)

Western-relevant Enhancements in 2008 NEI

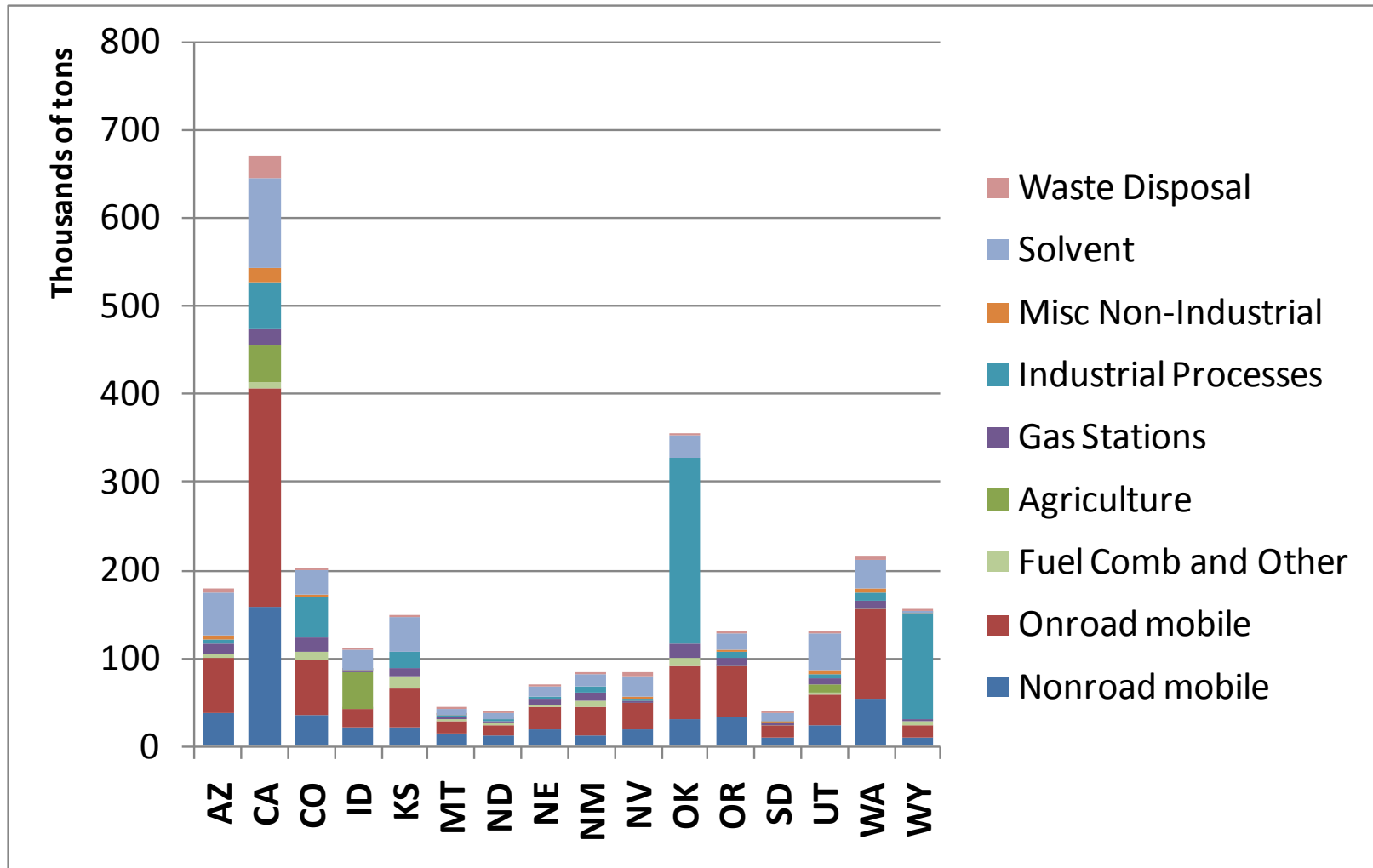
- EIS use allows...
 - More automated QA during data submission
 - Data partners to have direct database access to their (and other's) data
 - Faster turnaround by EPA from submission to release
- Oil & gas sector appears more highly characterized than past inventories
- More consistent nonpoint methods (based on state-EPA collaboration on methods via ERTAC)
- PM condensable estimates improved for EGUs
- Locomotive and marine methodology improvements

2008 NEI NOx emissions by state*



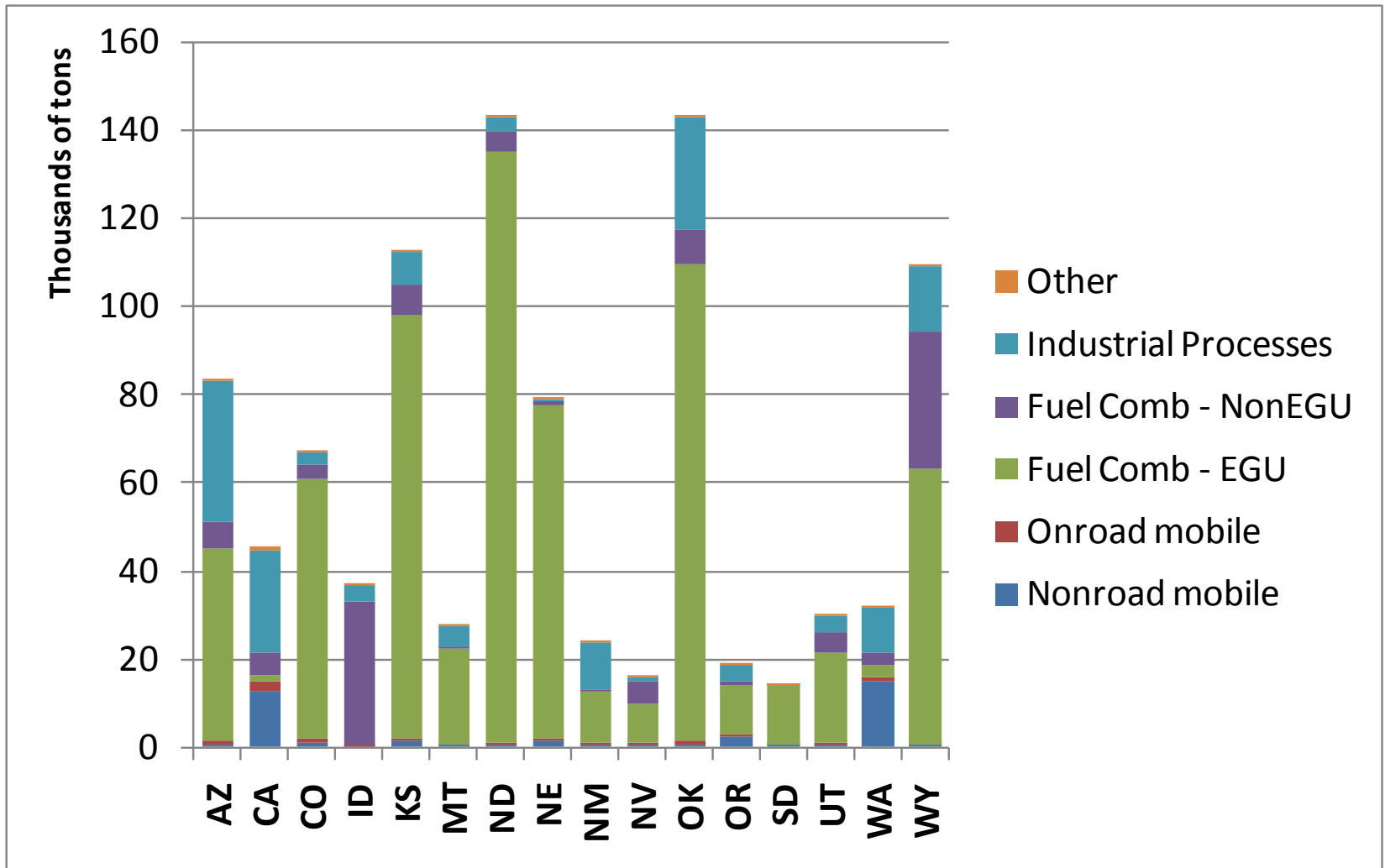
* Except for California (EMFAC), onroad mobile sources based on MOBILE6 rather than MOVES

2008 NEI VOC emissions by state*

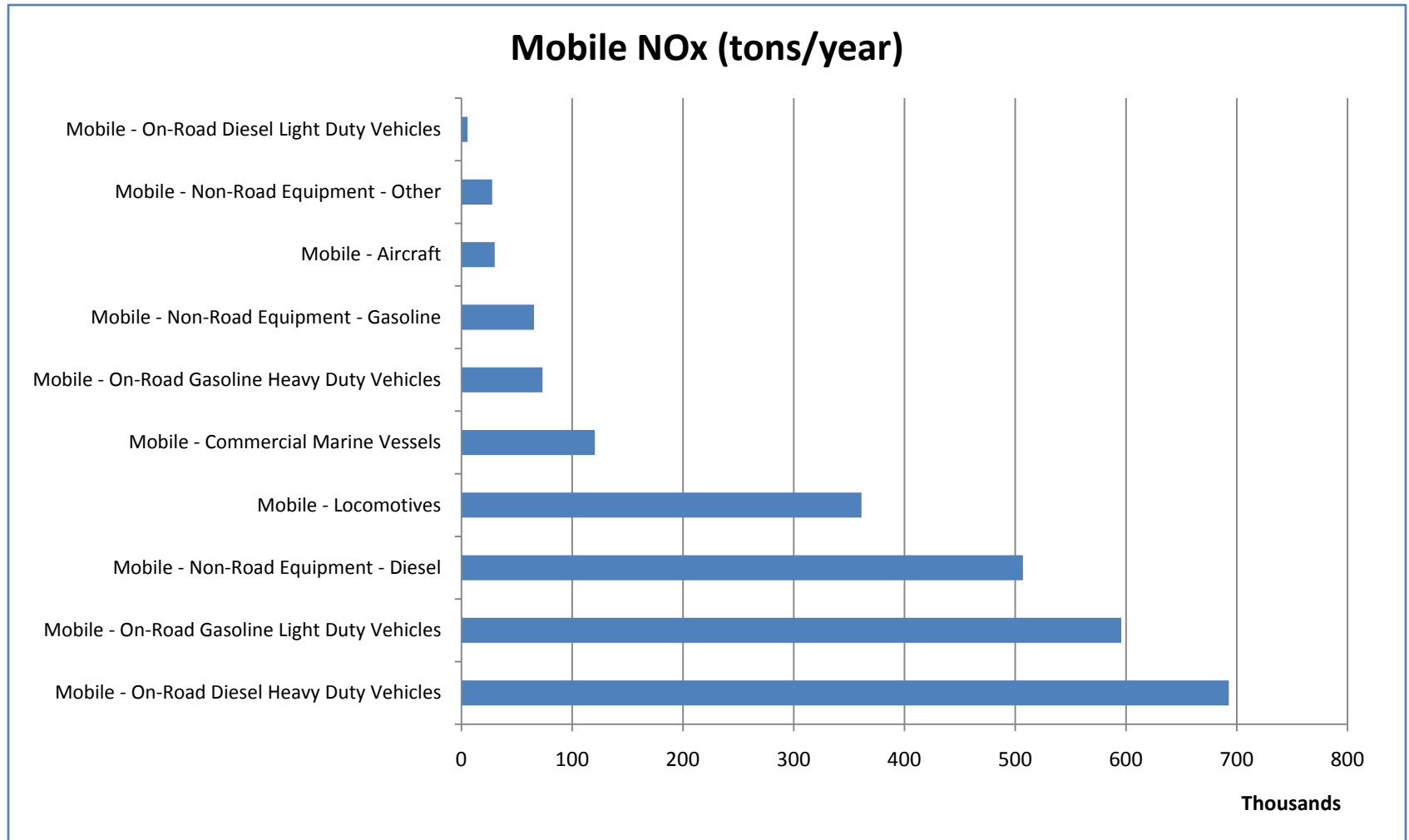


•Except for California (EMFAC), onroad mobile sources based on MOBILE6 rather than MOVES
 -Interesting that only 3 states show up with Agriculture VOC (pesticide application?)

2008 NEI SO₂ emissions by state

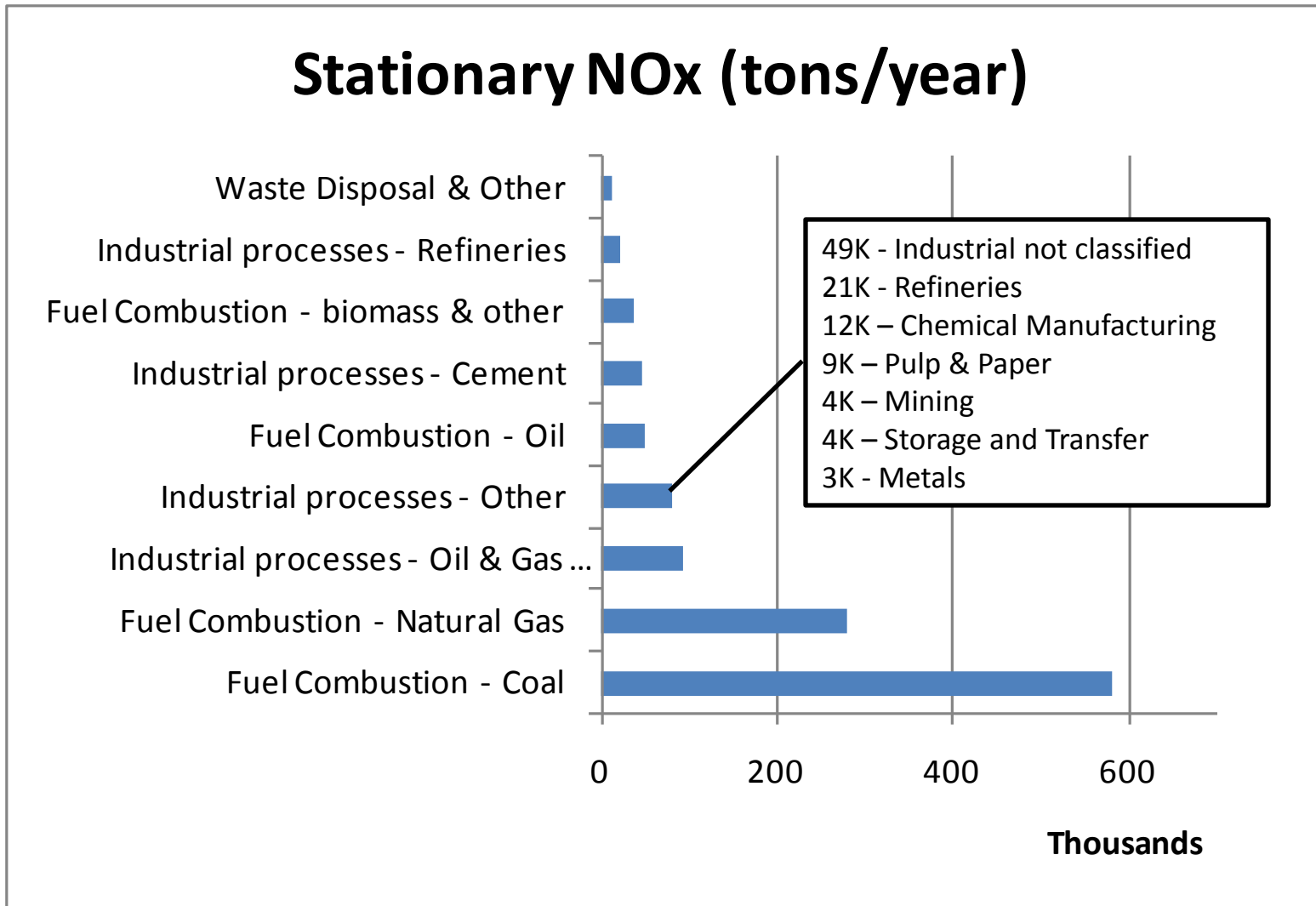


2008 Western Mobile* NOx sources

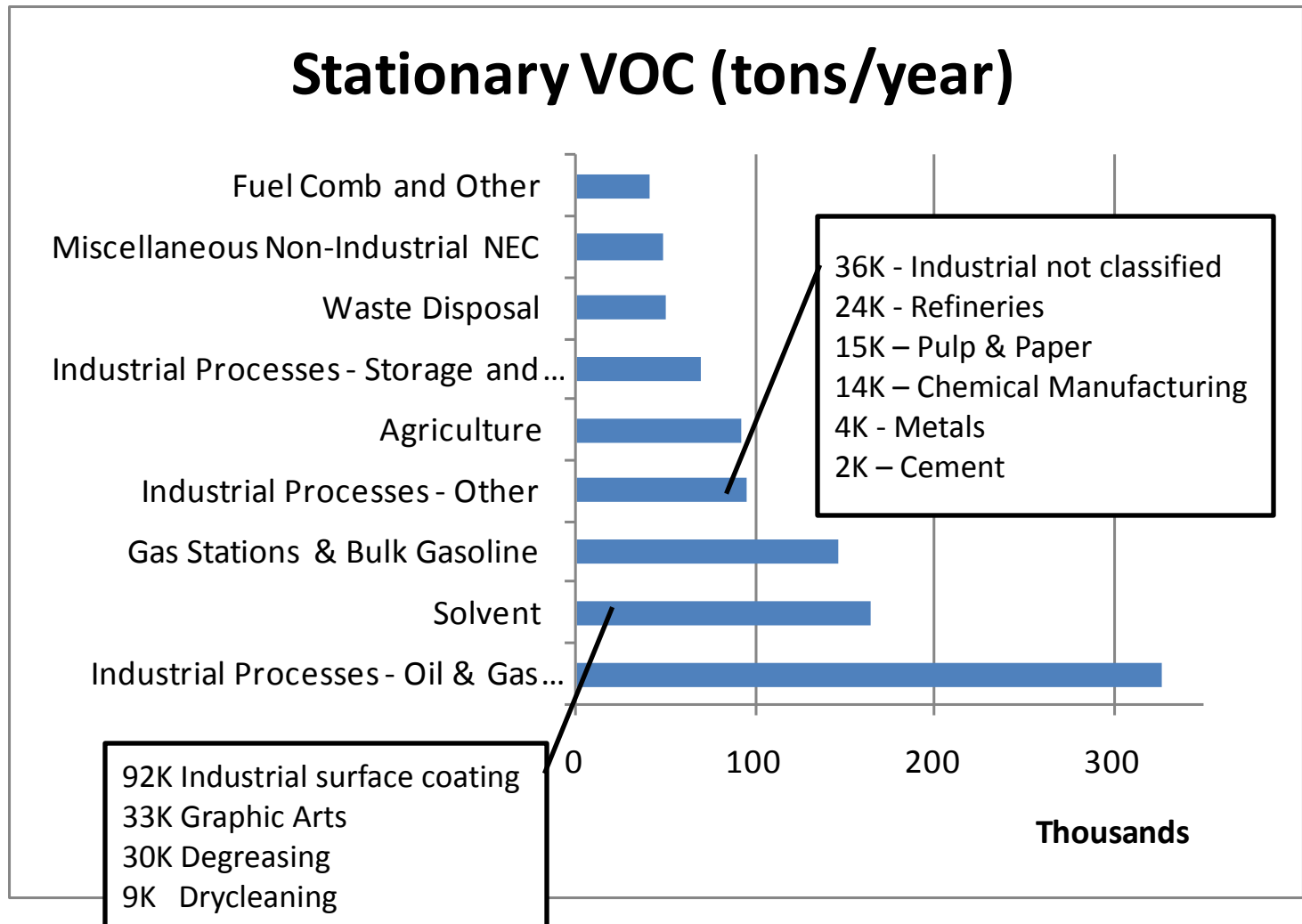


* Except for California (EMFAC), onroad mobile sources based on MOBILE6 rather than MOVES

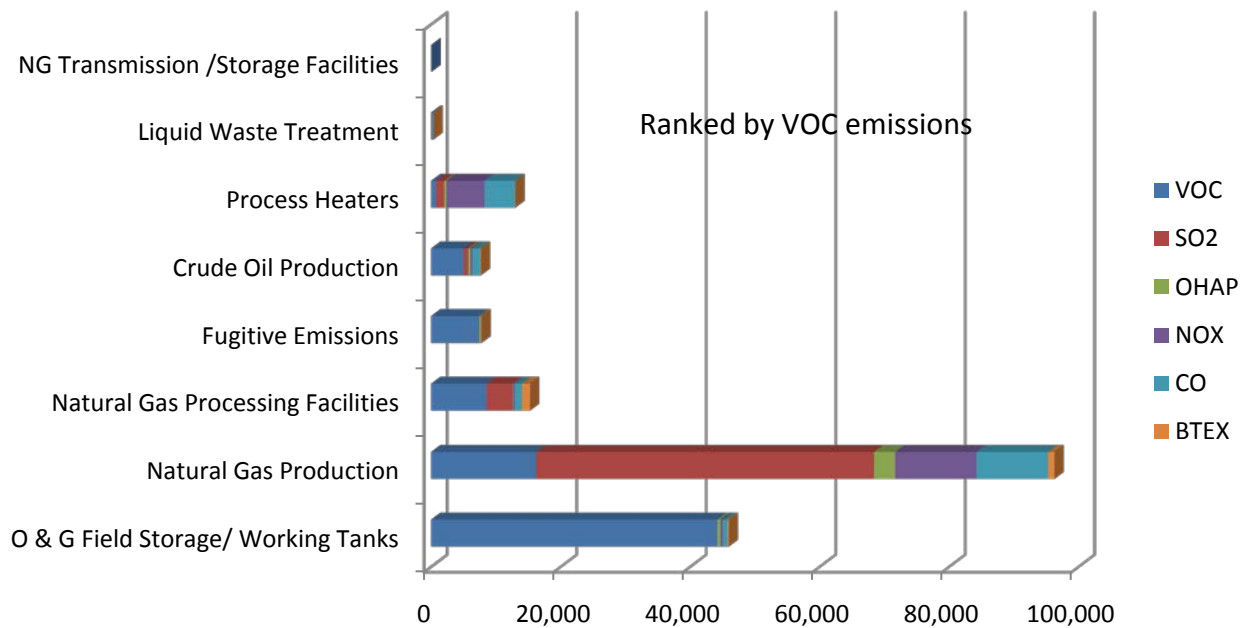
2008 Western Stationary NOx sources



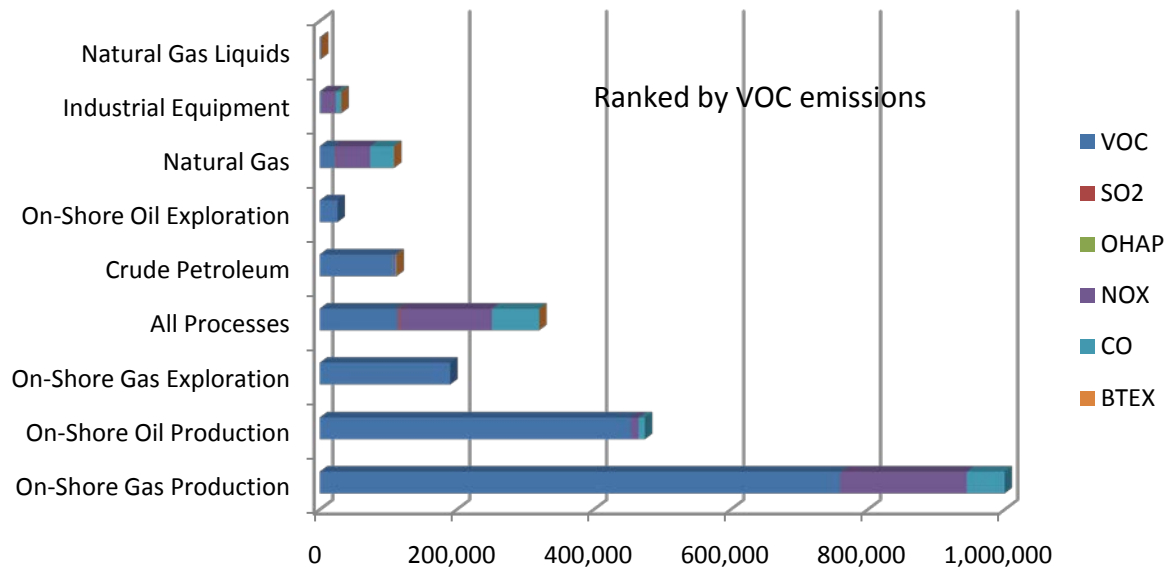
2008 Western stationary VOC sources



Point Sources - Oil & Gas Sectors 2008 National Air Emissions



Nonpoint Sources - Oil & Gas Sectors 2008 National Air Emissions



2008 NEI Oil and Gas Observation Highlights

Nationally

- Predominant CAP is VOC, followed by NO_x, CO and SO₂.
- Activities that inventoried most of the VOC are:
 - On-shore production of gas and oil – storage tanks, railcar and tank loading, fugitives, wellhead, gas well completion venting, pneumatics, dehydrators, drill rigs, lifts.
- Most of the VOC emissions are characterized as non-point sources.
- Most of the SO₂ and HAPs (including BTEX) are characterized as point sources.
- NO_x and CO are pretty evenly split between point and nonpoint source categories. For more details, see http://www.epa.gov/ttn/chief/net/2008nei_v1/v1_5_issues.xls

State-level

- 4 states make up 97% of the VOC **reported** emissions for oil & gas – TX, OK, WY, CO.
- TX & OK have highest NO_x and CO -approx 85% of national total- followed by WY & CA.
- AL contributes 30% of national **reported** total SO₂.
- Largest reported HAPs (including BTEX) are from CO, CA, TX.
- 5 out of the 7 states with highest VOC, report most emissions as nonpoint and most of those same states characterize BTEX emissions as point sources. CO and CA characterize VOC and BTEX in similar source category.
- MI indicates half of BTEX emissions from nonroad mobile equipment sources.

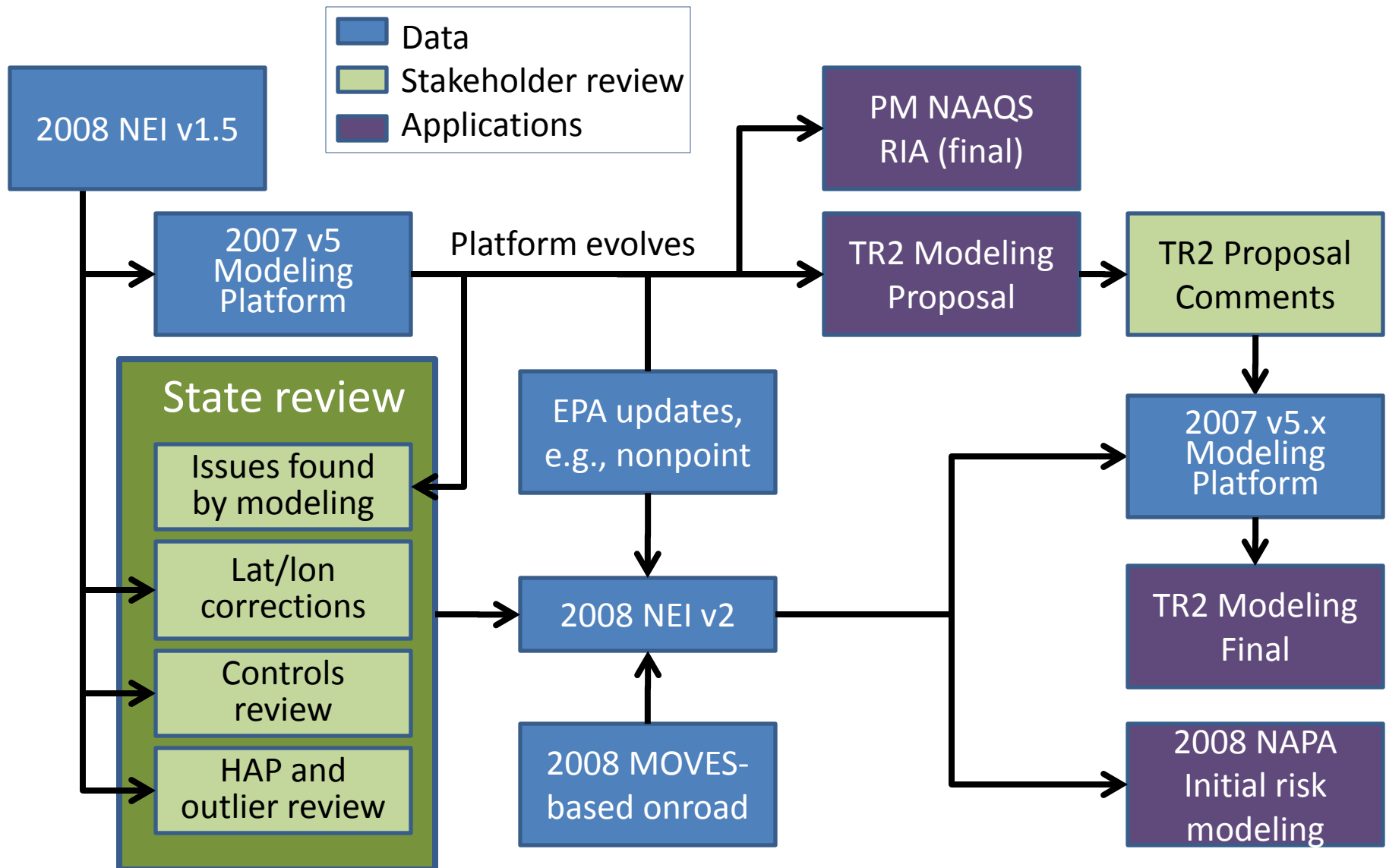
2008 NEI Review Steps and Timing

Quality issue	EPA Provides Information	State review by
Lat/lons outside of reported county	June 2011	July 2011
Incomplete control information for analysis associated with Transport Rule 2 and PM NAAQS final RIA	August 1, 2011	September 2011 (for inclusion in TR2 proposal analysis) October 2011 (for 2008 NEI v2)
Incomplete HAP emissions for “high” risk NATA facilities. HAP emissions outliers.	September 2011	October 2011
Issues identified through modeling shakeouts (issues not yet known)	September 2011	October 2011
Transport Rule 2 Proposal – opportunity by states for comment	TBD	TBD

Planned 2008 enhancements

- 2008 NEI v1.6 will be to release fires data
- 2008 NEI v2
 - MOVES-based onroad mobile
 - State point sources review efforts as requested by EPA
 - Lat/lons
 - Controls
 - HAPs and outliers
 - Other issues revealed through AQ modeling
 - Nonpoint updates (to fill in where states have not submitted)
 - Paved Roads methods update
 - Ag tilling
 - Mining and quarrying
 - Cremation
- Additional versions may result from regulatory actions (Transport Rule 2) and analysis efforts (National Air Pollutants Assessment)

2008 NEI Improvement and Use Plans

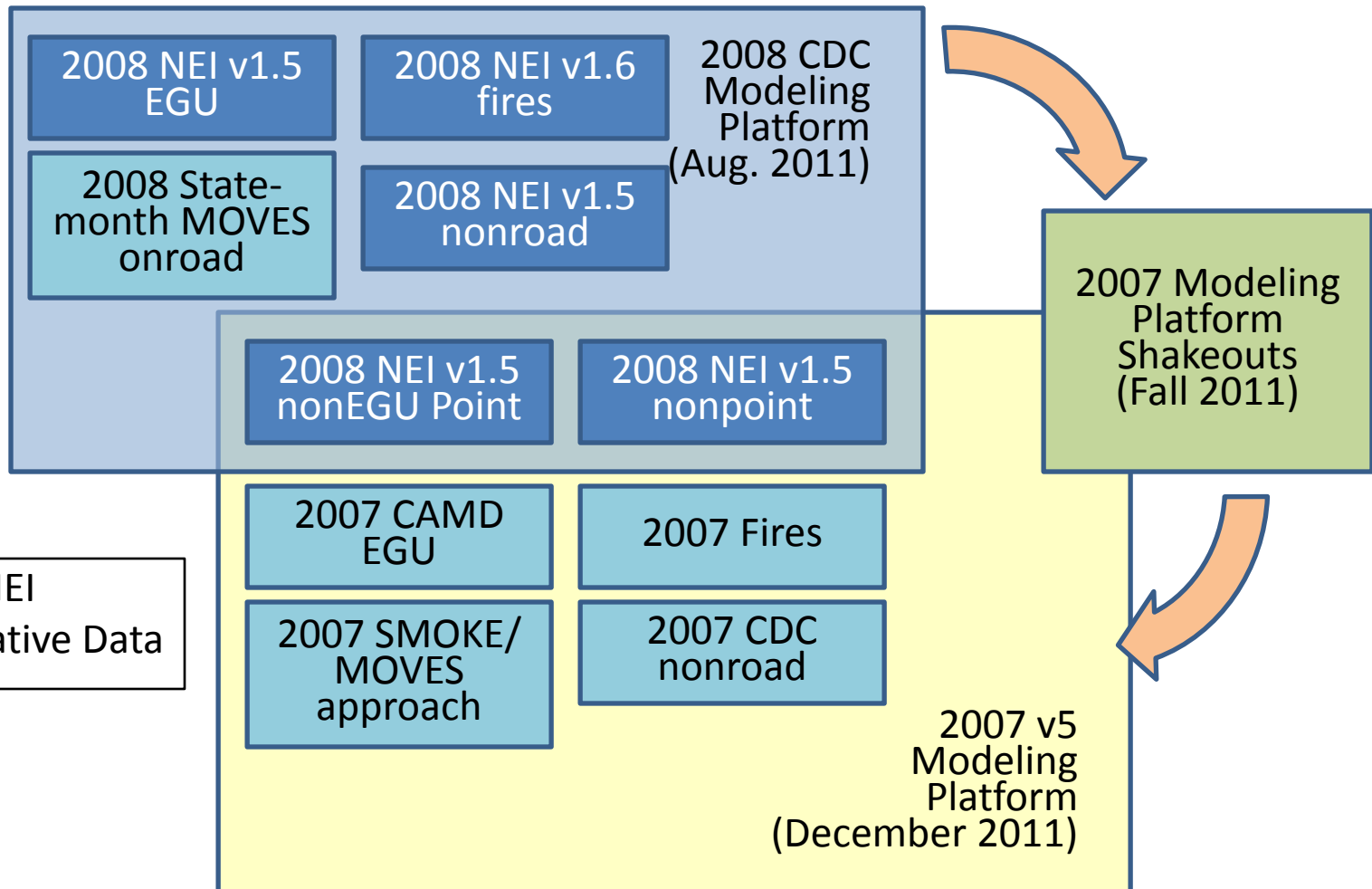


2007 and 2008 Modeling Platforms

- 2007 model year selected for primary platform
 - Expected to be used for Transport Rule 2, but management decision pending
 - Mix of 2007 data and 2008 NEI (next slide)
 - For proposal based on NEI v1.5, with updates as needed
 - For final based on response to comments and NEI v2
 - Also expect to use for PM NAAQS final RIA
- 2008 modeling being done for collaborative effort with Center for Disease Control (CDC)
 - Will use 2008 v1.5 directly with few (if any) enhancements except gap filling
 - Will use 2008 v1.6 for fires
 - Will not use SMOKE/MOVES approach, but will use MOVES emissions

2007 and 2008 Modeling Platforms

Evolution and Timing



General Emissions Modeling

High-level Overview

- Conversion of county/annual inventories to grid cell/hourly
- Non-NEI emissions:
 - Biogenics (version of emission factors and land use dataset)
 - Vintage of Canada and Mexico inventories
 - Incorporation of Lightning NO_x & Soil NH_3 Flux approach TBD
- Controls information (required) needed to be used for TR2 and NAPA
- Projections: IPM, MOVES, NONROAD, stationary, fires

2007 and 2008 Modeling Platforms

Collaboration outside OAQPS

- Interested in getting others using the 2008 NEI for modeling efforts and providing feedback
- EPA provides data as we use it for our own analysis
 - Inventory data
 - Ancillary data as we develop it
- Regular conference calls to collaborate and share experiences
- Feedback could feed into review process leading to 2008 NEI v2 and Transport Rule 2 Final platform
- Possible partners include ORD, NOAA, Regional Modeling Centers, Regional Offices, states

2007 and 2008 Modeling Platforms

More specific data collaboration interests

- Fires: making FETS tool data available for integration into SmartFire2
- Oil and gas
- Mexico and Canada, including projections
- PM2.5 model performance and priority sectors vs topography/MET/other possible issues
- Attention to PM10 with potentially tightened standard

2007/2008 Modeling Platforms

MOVES-based emissions

- Projects prior to April, 2011 used MOVES runs with national defaults + state level meteorology by month
 - Allocated to counties based on NMIM emissions
- SMOKE-MOVES currently being used for its first regulatory project for the years 2005, 2017, and 2030
 - Updates have been made to speed it up and to address some issues that were identified during this work
 - Using 106 representative counties and 2 fuel months
 - An annual / continental US run for the SMOKE part of SMOKE-MOVES can be run in about 4 days with 8 cores
 - Code/scripts used for this work will be released in June or July
- Discussing with OTAQ best way to handle 2007/2008
- Timing from OTAQ: cloud approach

2007/2008 Modeling Platforms

RWC and Animal NH3 Temporal allocation

- Work is ongoing to develop meteorology-based temporal allocation methods for residential wood combustion and ammonia from animal husbandry
- A preprocessor is used to develop temporal allocation factors by month, day, and/or hour
- The SMOKE temporal processor will accept the new factors to temporalize the emissions
- Beta versions of these programs will become available this summer for testing
- Sensitivity analysis needed to assess ***–looking for collaborator***
 - may not be available in time for TR2. ***How important is this to Western states?***

2007/2008 Modeling Platforms

Spatial Surrogate Improvements

- A task is starting to update the spatial surrogates that are used to allocate nonpoint and mobile sources to grid cells
- The census data-based surrogates will be updated with 2010 census data
- Surrogates based on FEMA HAZUS data (e.g., Industrial Land, Commercial + Industrial) will be updated with Circa 2010 data
- Other updates may be considered next year
 - Agriculture, TIGER-Line data (e.g. roads), etc.

2007/2008 Modeling Platforms

Average Fires and Speciation

- A project is just starting to develop an average-fire methodology with updated data (e.g., 2002-2010) for use in modeling projects
 - Leverages 2002-2008 point daily fires
- A version of the Speciation Tool that uses the new SPECIATE 4.3 and can create profiles for the upcoming CMAQ 5.0 has been developed
 - It may be possible to develop a public release of the tool once it has been more fully tested
- Other possible updates
 - Soil NH₃ flux
 - Lightning NO_x
 - Updated fugitive dust transport fractions approach

Emissions Modeling Projections

- EGUs: IPM/CEMS
- Onroad mobile: MOVES (plus AEO2011-based VMT)
- Nonroad mobile: NMIM/NONROAD
- Loco-CMV: OTAQ FRM projections
- Stationary non-EGU: closures, consent decrees, known controls/programs, activity data for select sources (ag, RWC, refueling, aircraft)
- Average fires, biogenics, non-US inventories

Emissions Modeling Projections Moving Forward

- Oil and Gas
 - Options for states resubmittal?
 - Composite datasets for EIS and point/non-point reconciliation?
- Industrial non-EGUs
- Improved base year controls information

Next Steps: Possible Areas of Collaboration

- MET-based RWC & Animal NH_3 temporalization
- Soil NH_3 flux & source-based ag/residential fertilizer
- Biogenics land use and emissions factors & possible future-year data?
- Obtaining updated Canada/Mexico –both base and future year(s)
- Oil and Gas
- Missing sources (SD non-EGU point, ag tilling,...)
- Integrating Fire Emissions Tracking System (FETS) data into SmartFire (SF2) to improve ID & classification of fires
- Reevaluation of “important” source categories with tightened annual/daily $\text{PM}_{2.5}$ standard
 - tightened PM_{10} standard impact?
 - impact of revised paved roads PM_{10} decrease, $\text{PM}_{2.5}$ increase

Acknowledgements

- EPA/OAR/OAQPS/AQAD/EIAG NEI, EMT, and DATs, in particular:

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Roy Huntley

Venkatesh Rao

Appendix

Screen Shot of 2008 NEI web site

U.S. ENVIRONMENTAL PROTECTION AGENCY

Technology Transfer Network Clearinghouse for Inventories & Emissions Factors

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CHIEF Home
Emissions Inventories
Conferences
Publications & Archive
Related Sites
Site Index
Emissions Inventory System (EIS)
NEI Browser

The National Emissions Inventory

The National Emissions Inventory (NEI) is a comprehensive and detailed estimate of air emissions of both Criteria and Hazardous air pollutants from all air emissions sources. The NEI is prepared every three years by the USEPA based primarily upon emission estimates and emission model inputs provided by State, Local, and Tribal air agencies for sources in their jurisdictions, and supplemented by data developed by the USEPA. The 2008 NEI was built from emissions data in the [Emissions Inventory System \(EIS\)](#).

Version History: (For a detailed list of caveats and changes from version one, please see the [Version 1.5 issues](#) file.)

- Version 1.5 (released May 16, 2011): Key updates are to include the nonpoint data and major updates to point sources in Indiana, Maryland, Nebraska, and Lincoln/Lancaster air agencies.
- Version 1 (released April 4, 2011)

Detailed documentation for each of the five data categories Point, NonPoint, OnRoad, NonRoad, and Event are available below.

2008 National Emissions Inventory Data

[NEI Browser](#). Note that a public NEI Browser is available that currently retrieves NEI data for only the Criteria air pollutants.

Sector Summaries - Criteria and Hazardous Air Pollutants by 59 emission sectors

*To use the multiple selection boxes hold CTRL and click on options you would like to include in your query. To select multiples in order click your first option then hold SHIFT + click the last selection to highlight everything in between. To unselect options use the same method as with selecting.
*Sector selections are limited to 12 states to avoid any timeout issues.

[This site uses pop-up windows, click here for help on allowing pop-ups from this site](#)

State / County	Geographic Aggregation
<input checked="" type="radio"/> State <input type="radio"/> County	Region 1 - Connecticut Region 1 - Massachusetts Region 1 - Maine Region 1 - New Hampshire Region 1 - Rhode Island Region 1 - Vermont
Pollutant	Sector
CAP - Ammonia CAP - Carbon Monoxide CAP - Nitrogen Oxides CAP - PM Condensable CAP - PM10 Filterable CAP - PM10 Primary (Filt + Cond)	Agriculture - Livestock Waste Bulk Gasoline Terminals Dust - Construction Dust Fuel Comb - Comm/Institutional - Biomass Fuel Comb - Comm/Institutional - Coal Fuel Comb - Comm/Institutional - Natural Gas

Screen Shot of EMCH 2008 NEI Files

**Technology Transfer Network
Clearinghouse for Inventories & Emissions Factors**

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Emissions Modeling Clearinghouse

The Emissions Modeling Clearinghouse (EMCH) has been designed to support and promote emission modeling activities both internal and external to EPA. Through this site the EPA intends to distribute emissions model input formatted inventories based on the latest versions of its National Emission Inventory databases. In addition to the emissions data, this site will be used to document and distribute the Agency's latest versions of the ancillary files used to support the temporal, spatial, speciation, and projection of these emissions. Although numerous links to other sources of emissions, modeling factors, and emissions models are available through this site, the EPA does not actively support the use of any one inventory, set of factors, or emissions models for input development to air quality modeling.

Site Directory

- [Toxics Rule Proposal - Emission Data](#)
- [Transport Rule Proposal - Emission Data](#)
- [2008 Based Modeling Platform](#)
- [2005 Based Modeling Platform](#)
- [2002 Based Modeling Platform](#)
- [2001 Based Modeling Platform](#)
- [Emissions modeling software tools](#)
- [Emissions modeling ancillary data \(Non-inventory data\)](#)
- [Related Links to Emissions Modeling Resources](#)

Toxics Rule Proposal - Emission Data

- Documentation
 - See 2005-Based Platform, Version 4.1 ([below](#)) for documentation on 2005
 - These two documents summarize the development of the 2005 and focus on 2016 emissions used for the Toxics Rule Proposal
 - [Proposed Toxics Rule Technical Support Document - Emissions Inventories](#) (pdf 61 pp, 1784 KB)
 - [Appendices to the Proposed Toxics Rule Technical Support Document](#) (pdf 42 pp, 992 KB)
- Data Files - See 2005-Based Platform, Version 4.1 ([below](#)) for data files 2005 and 2016

Transport Rule Proposal - Emission Data

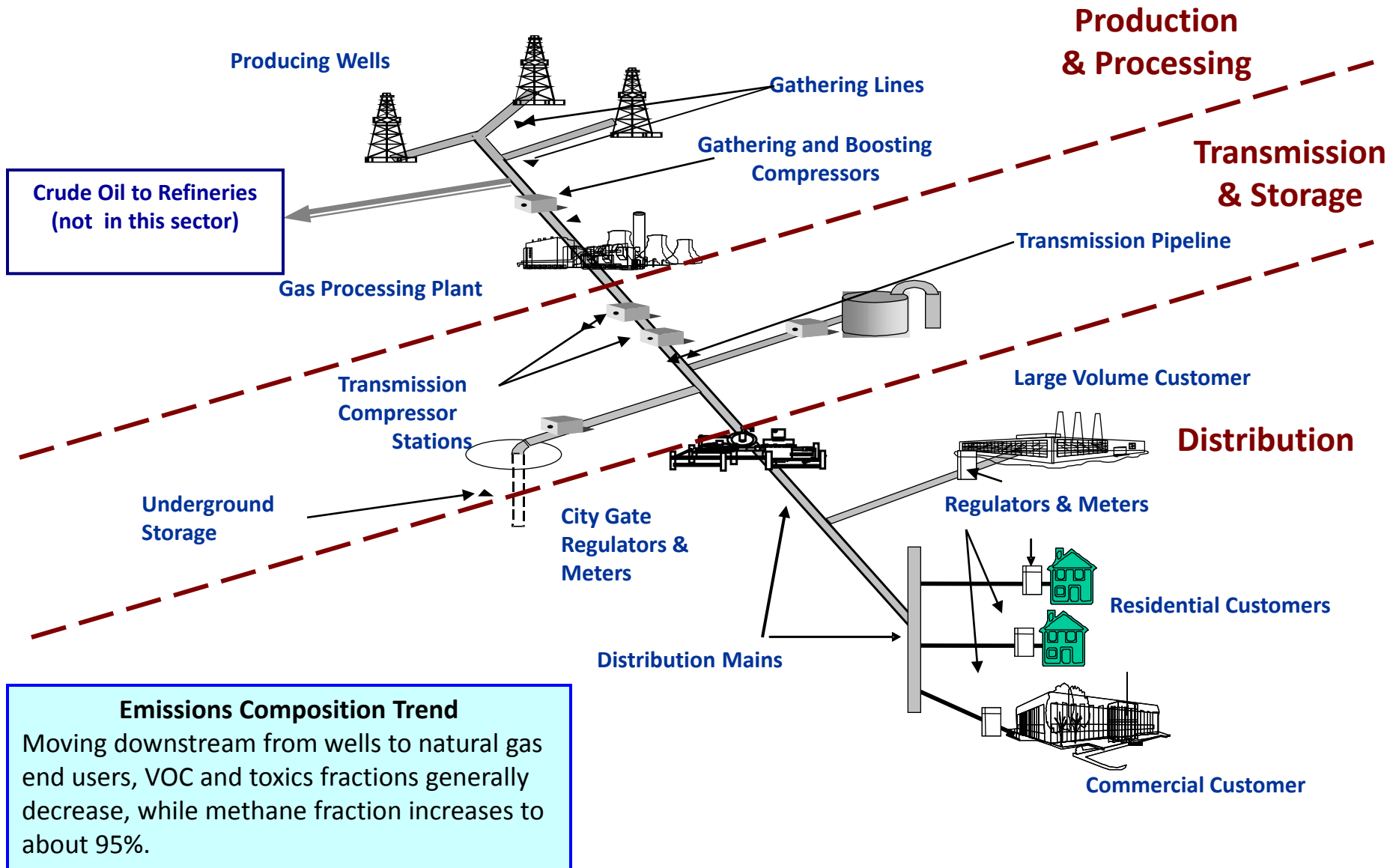
- Documentation
 - See 2005-Based Platform, Version 4([below](#)) for documentation on 2005
 - [Transport Rule Technical Support Document - Emissions Inventories](#) (pdf 75 pp, 639KB)
 - [tr_proposal_projection_comments_9-23-10.xls](#) (Excel 4.8MB) - Updated September 23, 2010
- Data Files
 - [2005 Emissions Data](#)
 - [2012 Emissions Data](#)
 - [2014 Emissions Data](#)
 - [2010 and 2014 control and projection data in SMOKE input format](#)
 - [Emissions processing scripts](#)
 - [Transport Rule Emission Inventory NODA](#) (10/25/2010)
- Summary files
 - [State-modeling sector 2005, 2012, 2014](#) (Excel, 232KB)

2008-Based Modeling Platform (Under Development)

EPA is in the process of developing a modeling platform that will make use of data from the [2008 National Emissions Inventory](#). EPA is providing early access to emissions modeling-related files that may be of interest to the community. Warning: The posted files may not yet have been used in any modeling projects and unexpected problems may arise when they are used. Note that code tables referenced by the inventories can be decoded using the [EIS Code Tables](#).

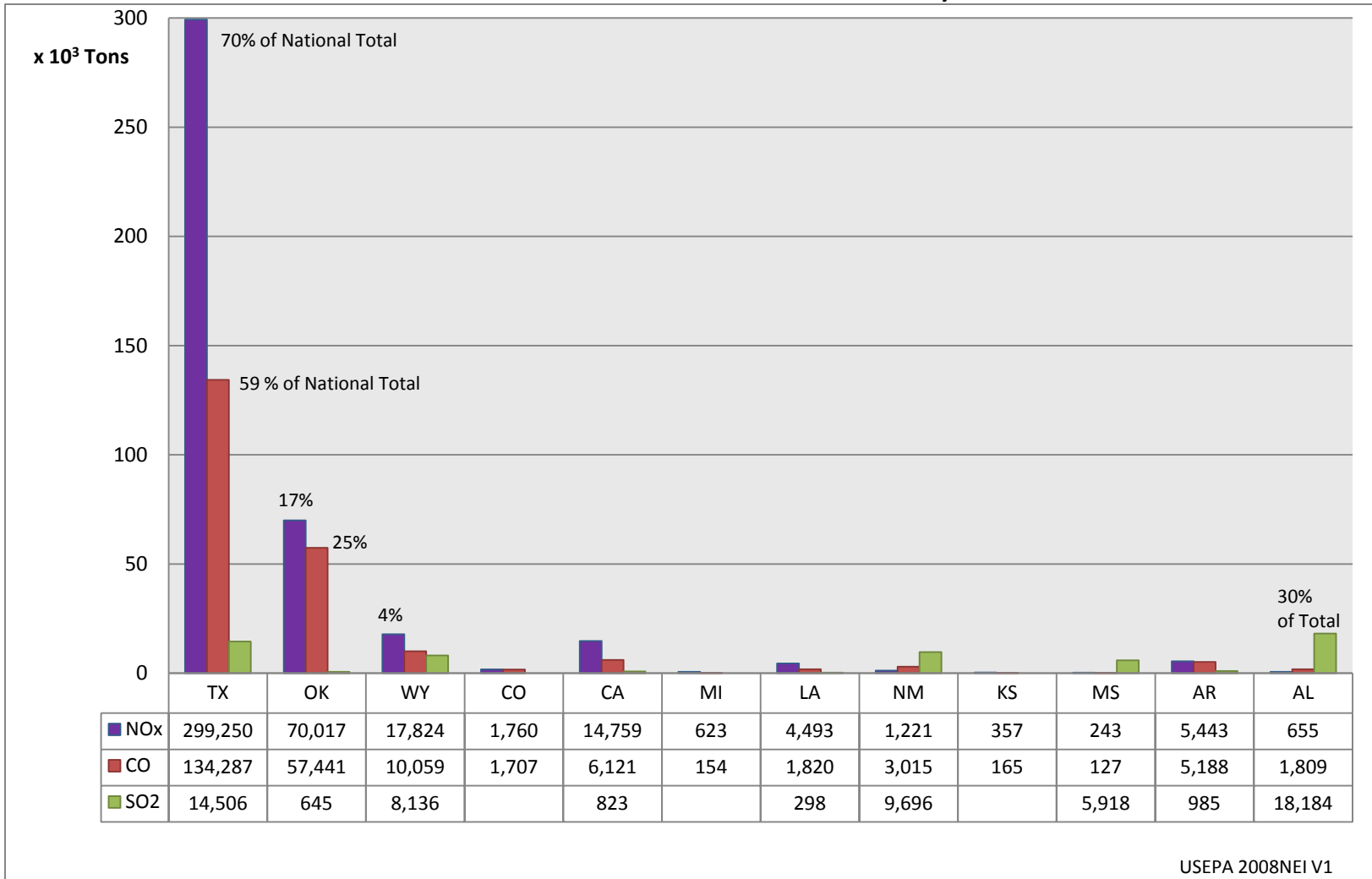
- [2008 Emissions Data files](#)

Oil and Natural Gas Operations



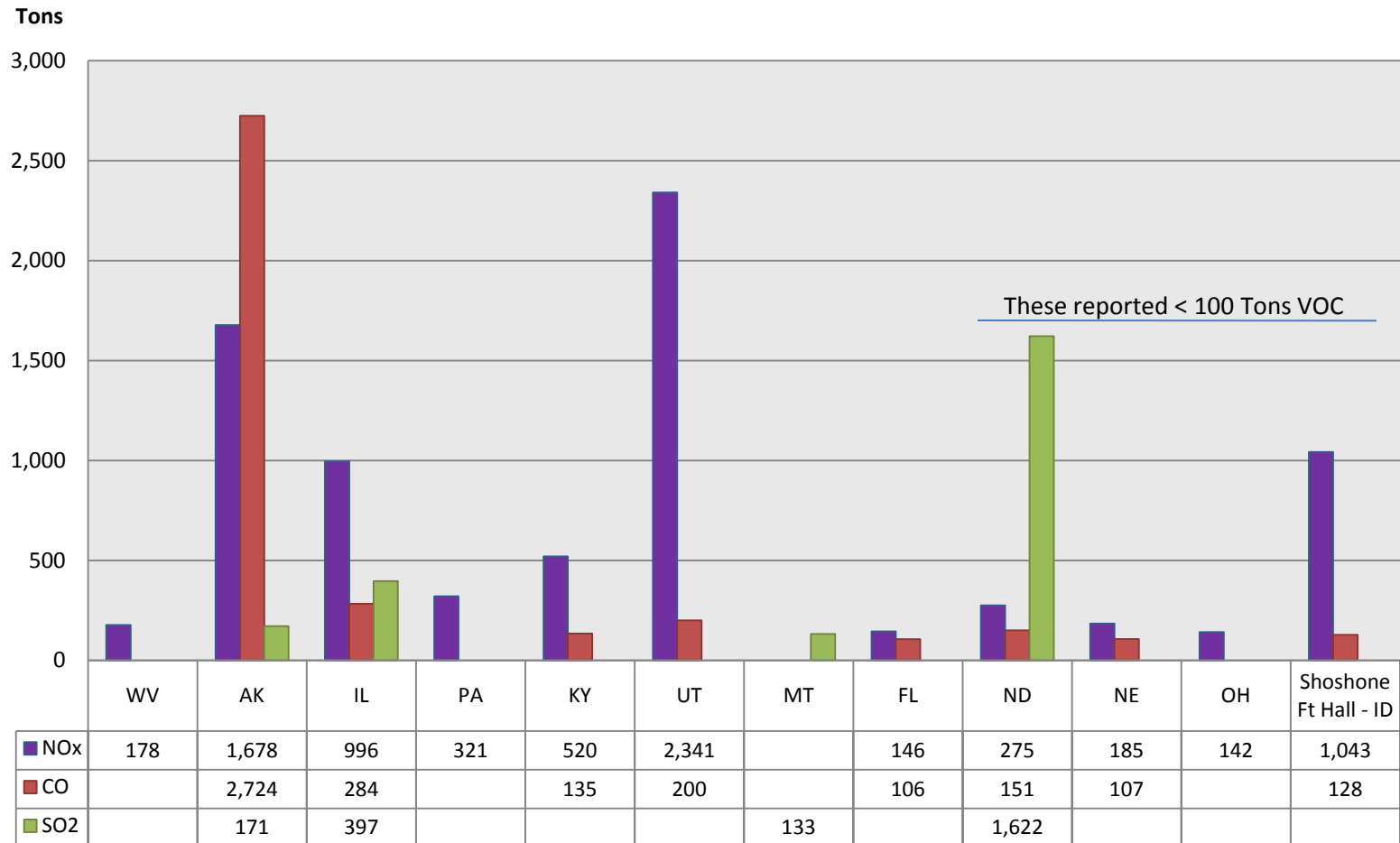
Oil and Gas 2008 NOX, CO and SO2 Emissions

for states w/ VOC > 1,000 tons/yr



Oil and Gas 2008 NOX, CO and SO2 Emissions

for states w/ VOC < 1,000 tons/yr



Residential Wood Combustion Submittals

- 22 states, 4 Locals, 12 tribes
 - AL, **CA**, **CO**, DE, GA, **ID**, IL, IN, **KS**, LA, MD, ME, MI, MN, NC, NJ, NY, OH, **OR**, SC, TN, **UT**
 - **Clarke County, Maricopa County, Nashville, Washoe County.**
 - Eastern Band of Cherokee Indians , Kootenai Tribe of Idaho , Makah Indian Tribe of the Makah Indian Reservation , Nez Perce Tribe of Idaho , Northern Cheyenne Tribe of the Northern Cheyenne Indian Reservation, Montana , Omaha Tribe of Nebraska, Prairie Band Potawatomi Nation, Pueblo of Pojoaque, Red Lake Band of Chippewa Indians, Sac & Fox Nation of Missouri in Kansas and Nebraska, Shoshone-Bannock Tribes of the Fort Hall Reservation of Idaho, Washoe Tribe of California and Nevada

Agricultural Tilling Submissions

- 13 states, 3 locals, 6 tribes
 - **AZ, CA, DE, GA, HI, ID, IL, KS, LA, MA, NH, NJ, VT**
 - **Maricopa County, Albuquerque, Nashville TN**
 - Shoshone-Bannock Tribes of the Fort Hall Reservation of Idaho, Nez Perce Tribe of Idaho, Kootenai Tribe of Idaho, Omaha Tribe of Nebraska, Prairie Band Potawatomi Nation, Sac & Fox Nation of Missouri in Kansas and Nebraska

Animal Husbandry Submissions

- 15 States, 3 Locals, 6 Tribes
 - AL, **AZ**, **CA**, DE, GA, HI, **ID**, IL, KS, LA, MA, NH, NJ, UT, VT
 - **Albuquerque** , **Maricopa County**, Nashville
 - Kootenai Tribe of Idaho, Nez Perce Tribe of Idaho, Omaha Tribe of Nebraska, Prairie Band Potawatomi Nation, Sac & Fox Nation of Missouri in Kansas and Nebraska, Shoshone-Bannock Tribes of the Fort Hall Reservation of Idaho,

Fertilizer Application Submissions

- 11 States, 2 Locals, 3 Tribes
 - **AZ, CA, DE, HI, IL, IN, KS, LA, MD, OH, WA**
 - Chattanooga, **Maricopa County**
 - Omaha Tribe of Nebraska , Prairie Band Potawatomi Nation, Sac & Fox Nation of Missouri in Kansas and Nebraska

Paved Road Submissions

- 16 States, 4 Locals, 13 Tribes
 - **AZ, CA, CO**, DC, DE, HI, **ID**, IN, **KS**, LA, MD, NC, NJ, OH, VT, **WA**
 - Chattanooga, **Maricopa County**, **Washoe County**, Nashville
 - Fond du Lac Band of the Minnesota Chippewa Tribe, Kootenai Tribe of Idaho , Little River Band of Ottawa Indians, Michigan, Makah Indian Tribe of the Makah Indian Reservation , Nez Perce Tribe of Idaho , Northern Cheyenne Tribe of the Northern Cheyenne Indian Reservation, Montana , Omaha Tribe of Nebraska , Prairie Band Potawatomi Nation , Pueblo of Pojoaque , Red Lake Band of Chippewa Indians , Sac & Fox Nation of Missouri in Kansas and Nebraska , Shoshone-Bannock Tribes of the Fort Hall Reservation of Idaho , Washoe Tribe of California and Nevada ,

Unpaved Road Submissions

- 15 States, 3 Locals, 10 Tribes
 - **AZ, CA, CO**, DC, HI, IN, **KS**, LA, MD, NC, NJ, OH, **UT**, VT, **WA**
 - Chattanooga , Nashville, **Washoe County**
 - Eastern Band of Cherokee Indians , Fond du Lac Band of the Minnesota Chippewa Tribe , Makah Indian Tribe of the Makah Indian Reservation , Northern Cheyenne Tribe of the Northern Cheyenne Indian Reservation, Montana , Omaha Tribe of Nebraska , Prairie Band Potawatomi Nation , Pueblo of Pojoaque , Red Lake Band of Chippewa Indians , Sac & Fox Nation of Missouri in Kansas and Nebraska , Washoe Tribe of California and Nevada

Construction Dust Submissions

- 16 States, 5 Locals, 5 Tribes
 - AL, **AZ, CA**, DC, DE, HI, **ID**, IL, IN, **KS**, LA, MD, NH, NJ, OH, **UT**
 - Chattanooga , Louisville, **Maricopa County**, Nashville, **Washoe County**
 - Kootenai Tribe of Idaho, Little River Band of Ottawa Indians, Michigan, Nez Perce Tribe of Idaho, Prairie Band Potawatomi Nation, Shoshone-Bannock Tribes of the Fort Hall Reservation of Idaho