

EPA's Emission Estimation Tool for Oil and Gas Production for the 2011 NEI

2014 Midwest and Central States Air Quality
Workshop

April 22–24, 2104, St. Louis, MO

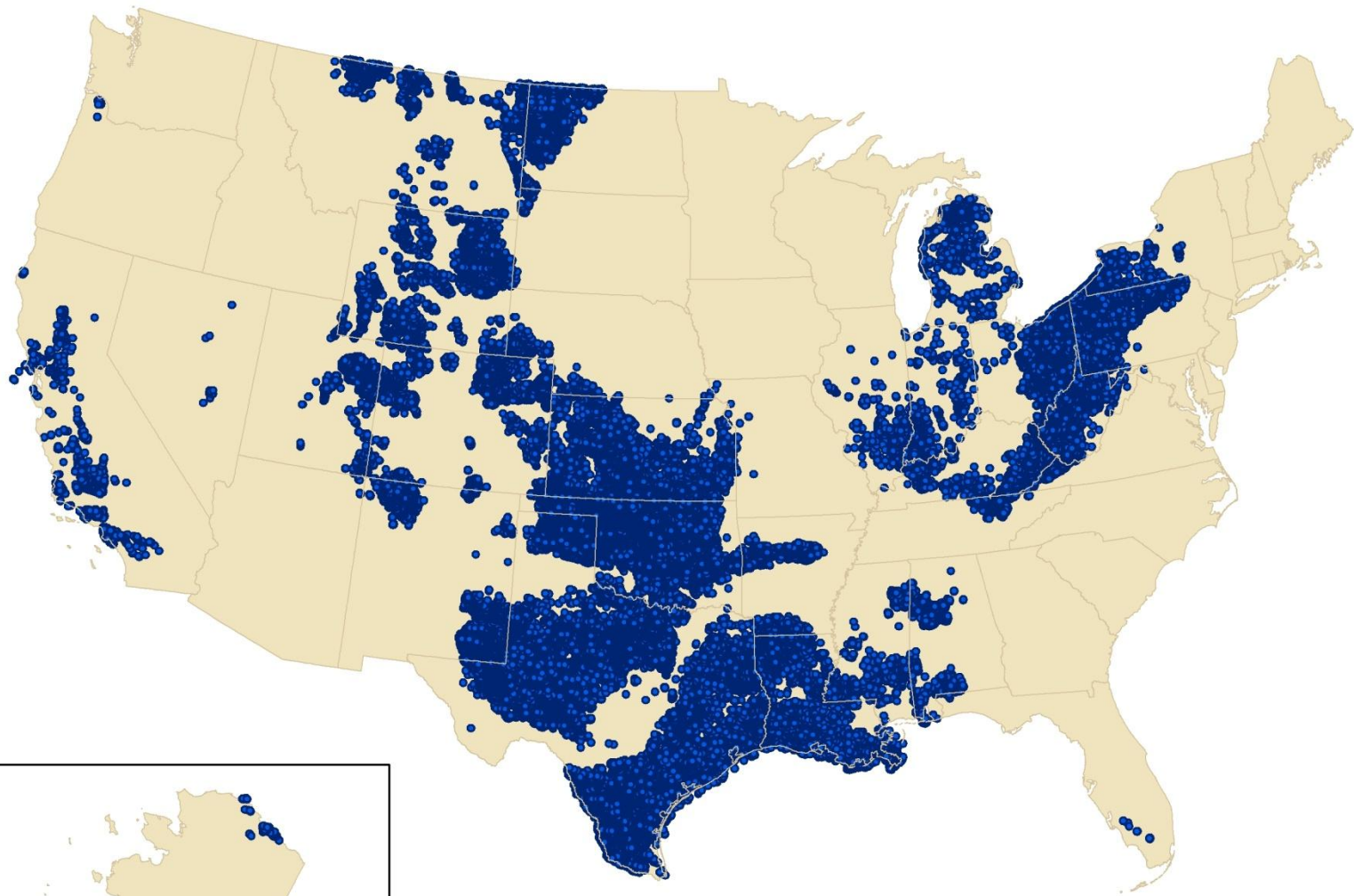
Roy Huntley, EPA

EPA's Emission Estimation Tool for Oil and Gas Production

- ▶ Why did we developed the tool?
 - Improve inventory
 - Missing emissions in 2008 NEI
 - IG recommendations
- ▶ Who helped us?
 - Collaboration with EPA, RPOs, States, Industry
- ▶ What does the tool do?
 - What emissions sources do we cover?
 - How does the tool work?
 - What are the data sources for inputs?
 - What are the outputs?
- ▶ Status
- ▶ Recent improvements

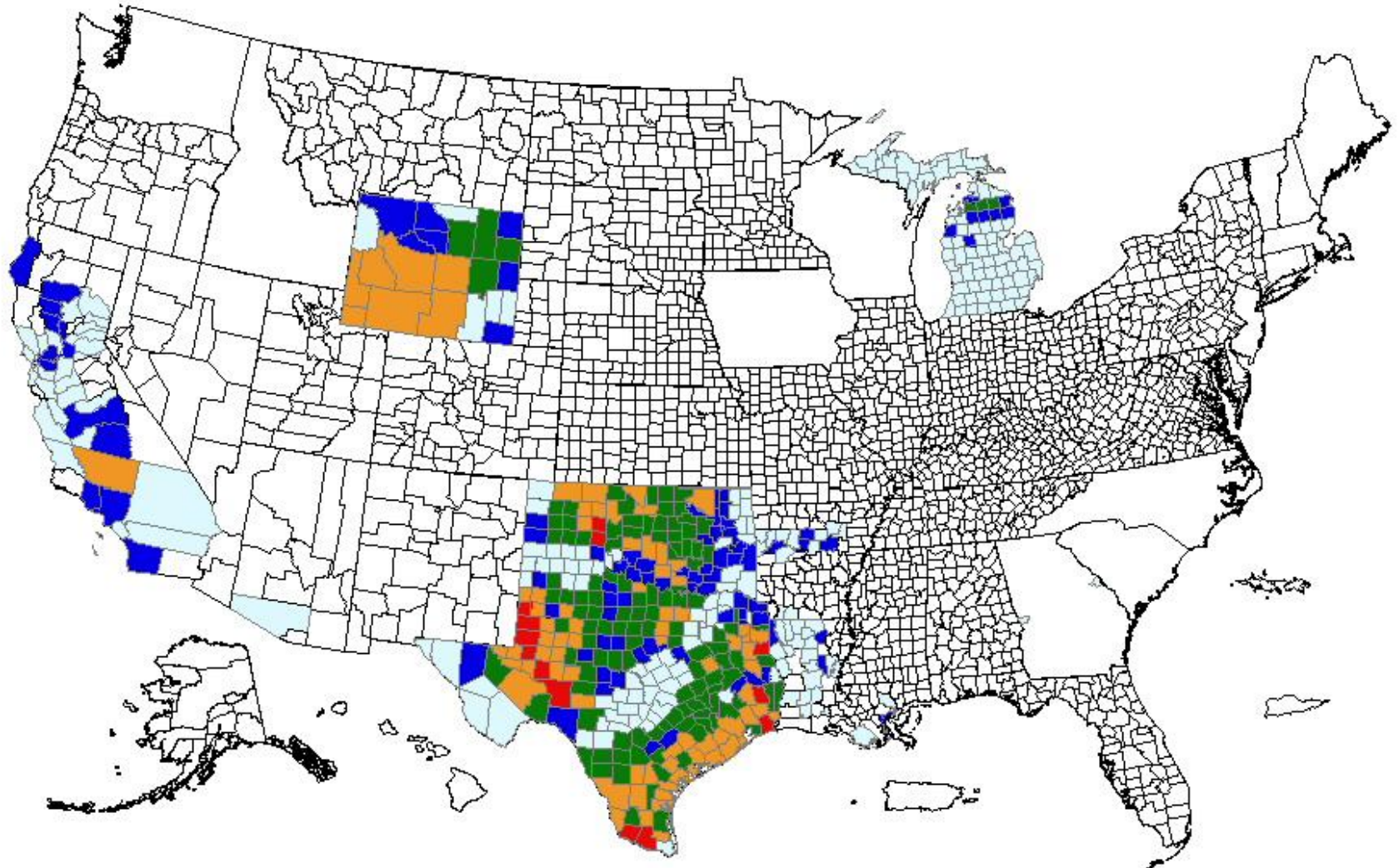
Emission Estimates Needed

- ▶ No NEI EPA O&G emission estimates prior to 2011
 - WRAP supplied some data, but many states submitted nothing for 2008
- ▶ EPA needs independent estimate of emissions from the oil and gas sector
- ▶ 2011 – Over 1 million operating wells across the country



2011 Well Locations

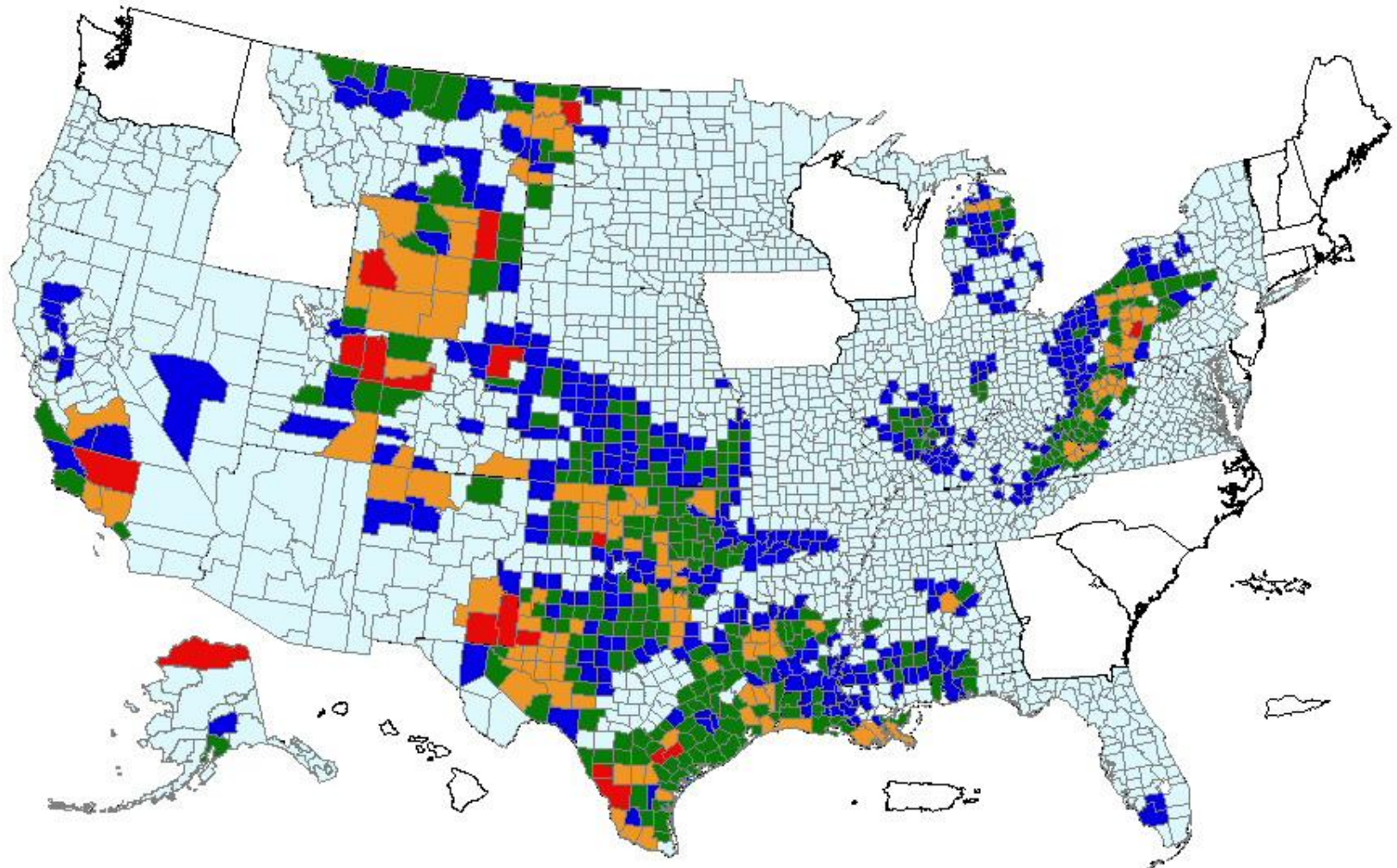
Oil and Gas VOC 08v3



2008 V3 O&G Sector, Pt and NP



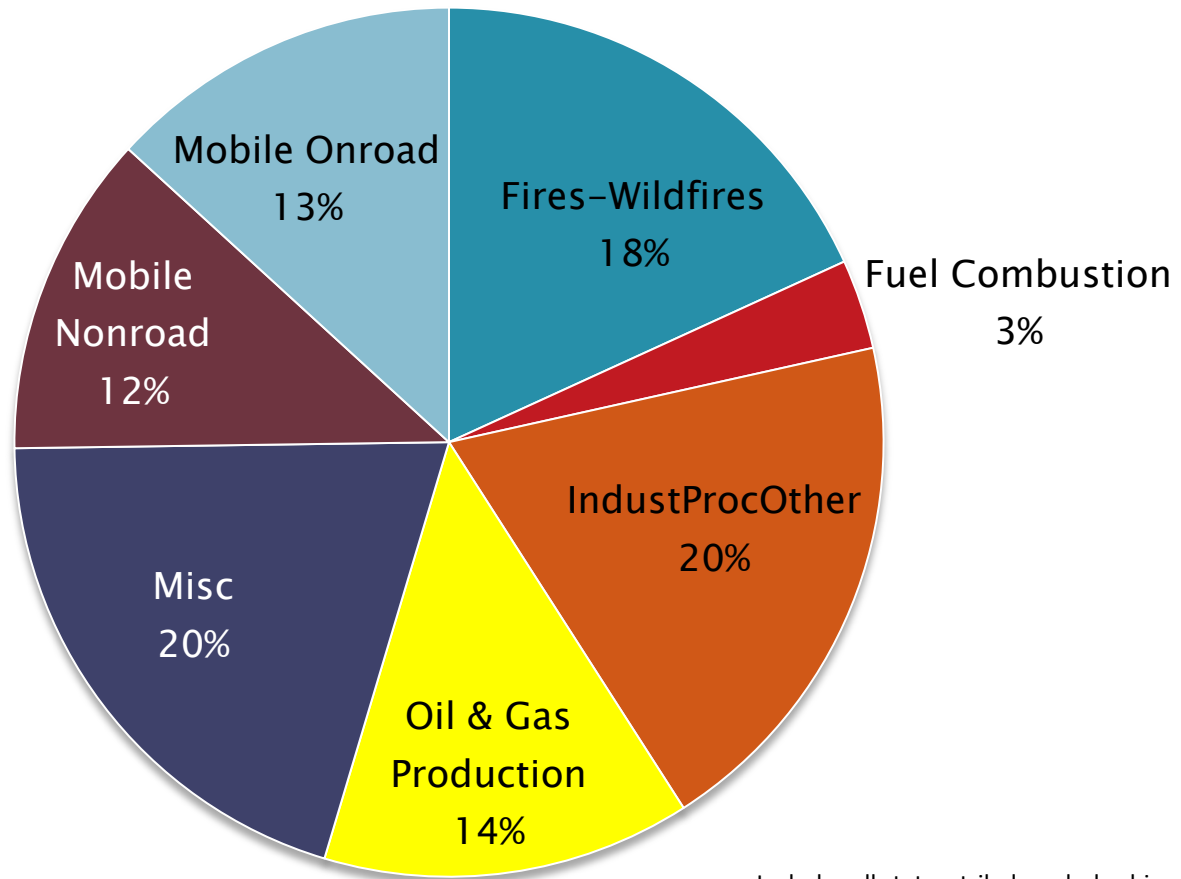
O&G VOC EPA Tool V1_4



2011 Estimates

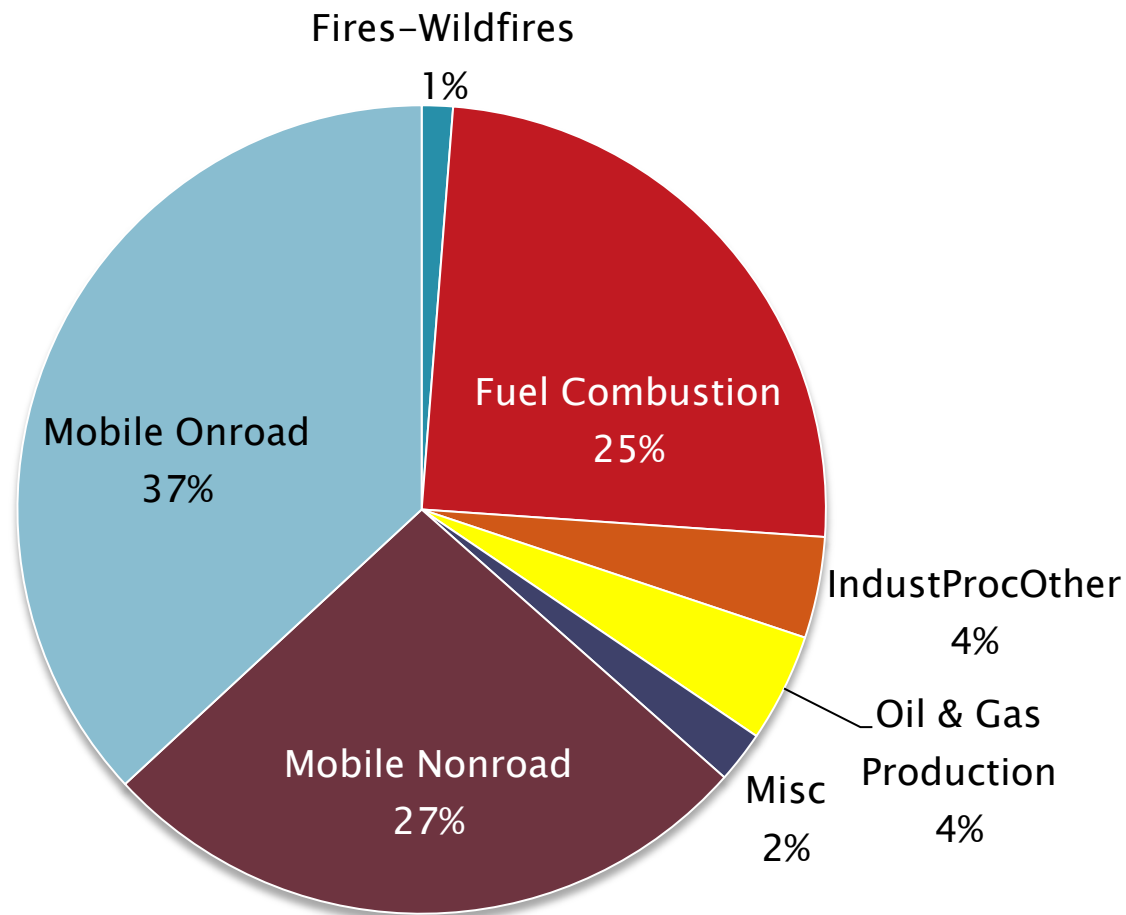


VOC – 2011 NEI v1 (all data categories)



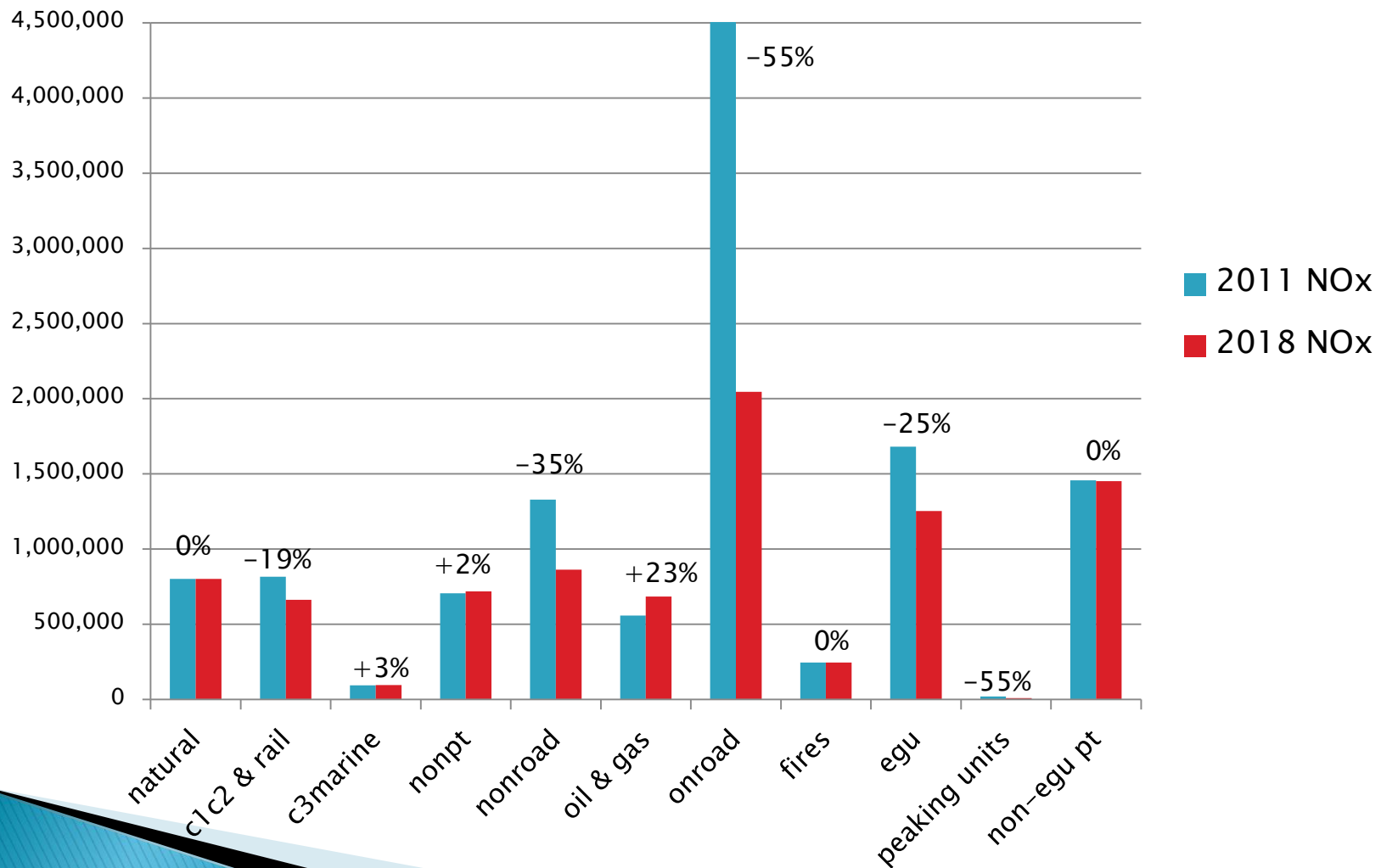
Includes all states, tribal; excludes biogenics

NOx – 2011 NEI v1 (all data categories)



Includes all States, Tribal; excludes Biogenics

2011 v1 vs 2018 (as of Jan 2014) Annual Eastern State NOx Emissions by Sector (-28% Overall)



Projections

- ▶ Based on estimated Annual Energy Outlook (AEO) 2013 using regional 2011–2018 growth factors
 - Oil production, natural gas production, and combined oil and natural gas activities
- ▶ Included impacts of NSPS
 - Reduction factors estimated from Climate Action Report
 - Assumed to impact VOC only
- ▶ Net growth rates computed from:
AEO growth + NSPS controls + other assumptions
- ▶ Summary reports and documentation available with 2011 Emissions Modeling Platform
 - <http://www.epa.gov/ttn/chief/emch/index.html#2011>

Photochemical Modeling

▶ VOC Speciation

- Basin-specific VOC speciation from WRAP Phase III project (e.g., Uinta, Powder River, Permian, Piceance)
- Would appreciate detailed speciation data for other basins

▶ Spatial Allocation

- Surrogates developed from 2km resolution shapefile for:
 - WRAP Phase III & Permian basins
 - Northeastern Region (includes Marcellus)
- Newly-developed (2014) national surrogates based on HPDI Drilling Info and oil and gas commissions

▶ Temporal Allocation

- Annual to monthly and day-of-week are flat
- Hour of day profiles currently have more emissions mid-day for nonpoint emissions, but perhaps should be flat

Office of Inspector General's Report (February 2013)

- ▶ Recommended that EPA:
 - Develop and implement a comprehensive strategy for improving air emissions data for the oil and gas production sector
 - Prioritize which oil and gas production emission factors need to be improved
 - Develop additional emission factors as appropriate
 - Ensure the NEI data for this industry sector are complete
- ▶ Recognized that OAQPS/EIAG was developing the tool
 - EPA's response to the IG included our work on this tool

National Committee Formed

- ▶ ERTAC (Eastern Regional Technical Advisory Committee) recognized need for development of national EPA emissions of criteria and HAP estimates for O&G sector
 - Established national committee
 - Members, OAQPS/EIAG (Roy Huntley & Jennifer Snyder) RPOs and MJOs (Westar/WRAP (Tom Moore), MARAMA (Julie McDill), CenSARA (Theresa Pella), Mark Janssen (LADCO)), and several state/county emission inventory experts
 - Prepared white paper regarding need for national estimates
 - EPA funding/resources became available to develop tool

Tool Development

- ▶ Based on estimation methodologies developed by CenSARA
 - Leveraged EPA resources by building on existing and generally accepted methodology
 - EPA's tool is built upon a similar tool developed for the CenSARA region, which included data and methodologies from operator surveys, permit reviews, literature reviews, the Climate Registry, and previous studies, such as one for the Haynesville Shale in NE Texas and the WRAP phase III study for the Rocky Mountain Region
 - Used HPDI data for activity that EPA already had purchased access to
 - HPDI (Drilling Info) – data from state O&G commissions
 - Expanded coverage to all States (not just CenSARA states)
 - Converted to MS Access (instead of Excel)

Oil & Gas Production Processes Covered by Tool

- ▶ Artificial lift engines
- ▶ Associated gas venting
- ▶ Condensate tanks
- ▶ Crude oil tanks
- ▶ Dehydrators
- ▶ Drilling rigs
- ▶ Flaring
- ▶ Fugitive leaks
- ▶ Gas-actuated pumps
- ▶ Heaters
- ▶ Hydraulic fracturing pumps
- ▶ Lateral compressors
- ▶ Liquids loading
- ▶ Liquids unloading
- ▶ Mud degassing
- ▶ Pneumatic devices
- ▶ Produced water tanks
- ▶ Well completions
- ▶ Wellhead compressors

Overview of Tool

▶ MS Access–based

- Needs to handle large amounts of data, inputs and outputs
- Ability to create front–end, user–friendly steps
- Portability/availability
- Combination of tables, queries, macros
- Logical grouping of tables and queries, use of message/instruction boxes
- Users can vary parameters by county or basin, as necessary

▶ Emission process selection

- Can run the tool on one or more of the processes
 - Processes coded with 34 Source Category Codes (SCC)
 - Some processes on previous slide have more than one SCC

Select Geographic Coverage

▶ Geographic selection

- State
- Multi-state
- Basin
- EPA Region
- RPO Region
- Nationwide
- EIA Supply Region
- NEMS Region
- Ozone Attainment Status

AREA_TYPE ▾	PICK_ONE ▾
EIA SUPPLY REGION	<input type="checkbox"/>
EPA REGION	<input type="checkbox"/>
NATIONWIDE	<input checked="" type="checkbox"/>
NEMS REGION	<input type="checkbox"/>
OZONE ATTAINMENT STATUS	<input type="checkbox"/>
REGIONAL PLANNING OFFICE	<input type="checkbox"/>
STATE	<input type="checkbox"/>
SUBPART W BASIN	<input type="checkbox"/>

Tool Data Sources for Inputs

- ▶ Activity Data: from state oil and gas commissions, state inventory office, Drillinginfo/HPDI, trade association data, all at county level
 - Well counts –
 - Oil, gas, Coal Bed Methane (CBM)
 - Production from oil wells, gas wells and CBM wells
 - Gas, oil/condensate,
 - Produced water from oil, gas, and CBM wells
 - Well Completion counts
 - For oil, gas, and CBM wells, Conventional and Unconventional (hydraulic fracturing)
 - Fraction of gas wells that need compression
 - Fraction of oil wells that need lift
 - Spud Information (aka, drilling starts)
 - Directional (horizontal, vertical) and feet drilled

Tool Data Sources

- ▶ Emission Factor Data (i.e., drilling & compressor engines, well completions)
 - EPA (EPA's GHG reporting program, AP-42, FIRE, SPECIATE, Equipment Leaks Protocol)
 - API (American Petroleum Institute)
 - ANGA (America's Natural Gas Alliance)
 - NONROAD model
 - Other sources (e.g., CenRAP (Central Region Air Planning Association), TCEQ (Texas Commission on Environmental Quality), Climate Registry)

Tool Data Sources

▶ Basin Factors

- Basins can vary significantly in composition/activity
 - Factors/profiles resolved down to county level
 - Equipment profiles
 - i.e., number of dehydrators or lateral compressors per well
 - Control profiles
 - i.e., fraction of well completion flared and control efficiency
 - Whole Gas Composition profiles
 - Percent VOC, benzene, toluene, etc.
 - Hours of Operation
 - Used State–provided factors where available, then EPA emission factors as defaults where available, then “CenSARA averages” when no better info available
- Data Sources
 - State/Local information
 - CenSARA study
 - EPA data
 - National Weather Service data

Tool Outputs/Information

- ▶ Data exported in EIS (Emission Inventory System) format
 - Formatting emission data to EIS format traditionally has been a hurdle for state inventory submitters
- ▶ Point source subtraction
 - User can subtract out point source contributions to prevent double counting
- ▶ Summary queries
- ▶ Basin factor and inputs activity glossaries
- ▶ Master references table
- ▶ Documentation of methodologies
- ▶ Directions on how to use tool

In Summary

- ▶ Tool is versatile
 - Can zero out processes
 - Can adjust parameters as needed
 - i.e., all well completions are controlled in Oklahoma
- ▶ We can use it again
 - Activity data can be revised for future years by data download from HPDI and update of applicable parameters
- ▶ Changes are relatively easy
- ▶ States can use on desktop or work with EPA to incorporate state values

Status of Tool

- ▶ Version 1.4 of the tool used in Version 1 of the 2011 NEI
- ▶ Version 1.4 reviewed by API
 - Received comments Jan 31; we are working to respond
- ▶ Version 2 of the tool– currently in review by the national committee
 - Expect to use the tool’s results to gap–fill in v2 of the 2011 NEI

Version 2 Changes

- Version 2 changes are significant
 - Includes CBM as separate calculation
 - Includes WRAP basin-specific factors for 7 basins in 4 states (CO, UT, MT, and WY)
 - Applies surrogate basin factors to 5 counties in NM
 - Updated methodology that determines number of well completions
 - Updated methodology to identify unconventional wells
 - i.e., Completions of hydraulically fractured wells
 - Revised several emission factors per API comments
 - Revised methodology for estimating fugitive emissions
 - Corrected some errors
 - Fugitive emissions from wellhead compressor seals

What is the Difference between the NEI and the Tool?

- ▶ NEI is a merge of State and EPA data
- ▶ States that submitted data NOT derived from the EPA tool
 - CA, WY, CO
- ▶ Used the EPA tool but changed parameters to make state specific (not including CenSARA states)
 - PA, WV, OH
- ▶ Used the EPA tool for select processes
 - TX
- ▶ Used the EPA tool with default data for some counties, not all
 - UT

Questions?