



# EPA's 2011 and 2018 Emissions Modeling Platforms

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December 12, 2013

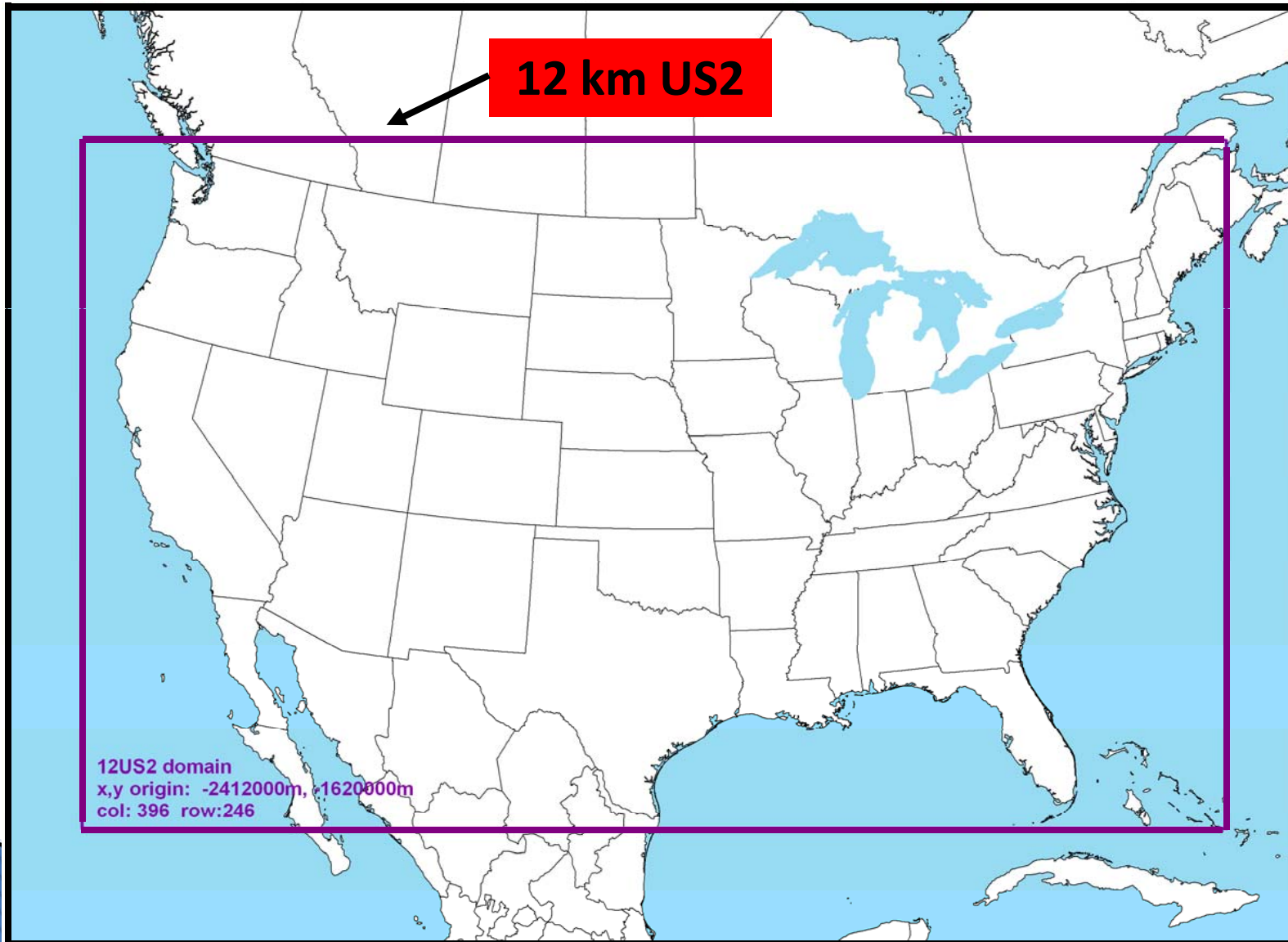


# Components of the Modeling Platform

- ▶ Non-Emissions Components
  - Air quality models: CMAQ, CAMx
  - Meteorological Models and Pre-processors: WRF, MCIP, wrfcamx
  - Vertical Resolution: 25 layer structure
  - Initial and Boundary Concentrations: 2011 GEOSChem global simulation
- ▶ Emissions Components
  - 2011 base year emissions inventories
  - 2018 future year emissions inventories
  - Emissions modeling data and scripts
- ▶ Modeling Domain



# National 12km Modeling Domain





# Power Sector Modeling



# Status of Power Sector Modeling

- ▶ On November 27, EPA made available the latest power sector modeling platform, associated data assumptions, and file documentation
  - [www.epa.gov/powersectormodeling](http://www.epa.gov/powersectormodeling)
- ▶ A new on-line form for questions and inquiries is also available
- ▶ In developing this platform, EPA has engaged with state air quality planning officials, power company representatives, regional transmission organizations, and others who have provided input on the data, assumptions, and structure of version 5.13, which is aligned with AEO 2013



# 2018 EGU Projections

- ▶ The updated version 5.13 documentation details all the assumptions that go into the power sector modeling projections
- ▶ Model output years are 2016, 2018, 2020, 2025, 2030, 2040, 2050
- ▶ 2018 unit-level projections and accompanying user guides
  - 2013 NEEDS input
  - State-level summaries
  - Air quality modeling-ready files
- ▶ Assumptions are based on:
  - AEO 2013 demand
  - Updated NEEDS v.5.13 (retirements, retrofits, new units)
  - Updated number of Regions (64 from 32)
  - Laws currently on the books (e.g., CAIR, MATS)
  - Updated regional and state actions (e.g., rules, settlements, consent decrees, BART-approved SIPs)



# 2011 Modeling Platform



# 2011 Modeling Platform Emissions Inventories

- ▶ Based primarily on 2011 National Emissions Inventory (NEI) Version 1
  - Consists of state/local/tribal data and EPA data for CAPs and HAPs
  - Data categories: Point, nonpoint, nonroad, onroad, and events (fires)
  - Released on September 30, 2013
  - Data, summaries, and draft documentation is available from 2011 NEI web page:  
<http://www.epa.gov/ttn/chief/net/2011inventory.html>
  
- ▶ Modeling platform inventories have some differences from the 2011 NEIv1





# 2011 Modeling Platform vs. 2011 NEI v1

- ▶ Uses CEMS data where available and match to NEI
- ▶ Uses MOVES from Tier 3 NPRM, while NEI uses MOVES 2010b
- ▶ Includes some additional VOC for CA nonroad (where HAPs existed and VOC did not)
- ▶ Adjusts dust emissions down using hourly gridded meteorology as opposed to monthly averages
- ▶ Includes some additional ethanol plants
- ▶ Incorporates LADCO Great Lakes inventory for commercial marine emissions
- ▶ Uses CARB-provided emissions for commercial-marine and rail emissions in California different from those in 2011 NEI v1
- ▶ Uses EPA commercial marine C3 emissions whereas NEI includes state-submitted data



# Availability of 2011 Emissions Modeling Platform

- ▶ Federal register notice published November 27, 2013 with docket EPA-HQ-OAR-2013-0743
- ▶ Data and reports available at <http://www.epa.gov/ttn/chief/emch/index.html#2011>
- ▶ Includes inventories, emissions modeling input files, and scripts
- ▶ Comments due March 31, 2014
  - Submit data updates to EIS where possible
  - If not EIS-submitter, or if commenting on emissions modeling files, submit data updates to the docket
  - Either way, submit descriptions of suggested changes to docket



# Topics for comment

- ▶ Data in the emission inventory flat files
  - Emission values – both annual and monthly
  - Stack parameters and locations
  - Boiler design capacities
  - Existing control techniques
  - Explanations of differences between NEI and CEMS data
  - Mobile source model inputs and activity data
- ▶ Emissions modeling data
  - Temporal allocation factors and cross references
  - Spatial surrogates and cross references
  - Chemical speciation factors and cross references
  - Data incorporated into spreadsheets for the first time
- ▶ Emissions modeling methods



# Supporting Data/ Reports

- ▶ See “details about 2011 data files” PDF file for more information on the provided files
- ▶ State level summary of pollutants by sector
- ▶ Emissions by sector, county, and month
- ▶ Stack parameter report
- ▶ CEMS vs. NEI data
- ▶ Spatial surrogate maps, documentation, and workbook showing how they are made
- ▶ Spatial cross reference data in spreadsheet
- ▶ Temporal and speciation cross reference and profile data in spreadsheets
- ▶ Comparison of the platform vs. 2011 NEI v1



# Future Plans for 2011

- ▶ Summaries will be updated shortly to account for a recently corrected double-count issue for dust that affected some states
- ▶ Follow up conference call for Q&A on the 2011 release to be held in early January
- ▶ Comments will be processed and those that are accepted are planned to be incorporated into NEI v2 targeted for September, 2014
- ▶ 2011 NEI v2 will be used for final version of 2011 NATA and will be the starting point for Transport Rule final modeling and NAAQS modeling projects



# 2018 Modeling Platform



# Development of the 2018 Emissions Modeling Platform

- ▶ Most non-inventory data is the same as the base year, including meteorology, domain, and IC/BCs
  - Some 2018-specific speciation profiles are used
- ▶ 2018 emission inventories are developed in different ways, depending on the sector
  - For all sectors, federal rules that go into effect in the intervening years are considered
  - Changes in sector activity are considered when possible
  - Future EGU emissions are output from IPM v5.13
  - Onroad and nonroad mobile source inventories are updated using future year model inputs including VMT growth and fuel changes
  - Stationary sources are also adjusted to account for consent decrees, planned shutdowns, etc.
  - 2011-specific point source fires are used for both years



# Availability of 2018 Emissions Modeling Platform

- ▶ 2018 emissions have just been completed
- ▶ They have not yet been modeled, but we are still providing the data publicly ASAP
- ▶ A new Federal Register notice and docket for the 2018 modeling platform release will be developed
- ▶ Targeting publication in early January
- ▶ EPA will be requesting comment on various aspects of projection methods and the resulting emissions data
- ▶ Comments will be due by June 30, 2014





# EGU Temporalization

- ▶ Temporalization is the “when” of emissions
  - High Electric Demand Day (HEDD)
  - Monthly and daily variability
- ▶ Matched 2011 NEI sources to 2018 IPM sources
- ▶ Maximized use of Continuous Emissions Monitoring System (CEMS) data
  - 2011 year-specific temporalization used for 2011 and preserved as much as possible into future years
  - Scaled CEMS to IPM seasonal emission totals for 2018
- ▶ Non-CEMS sources
  - Subset of 2011 and 2018 EGU sources did not use source specific CEMS
  - Developed IPM region- and fuel type-specific average profiles for non-CEMS sources based on 2011 CEMS data



# 2018 Onroad

- ▶ SMOKE–MOVES
- ▶ Starting point was the S/L/T provided inputs for 2011 NEIv1 plus some 2018–specific inputs
- ▶ MOVES version: Tier3 NPRM
- ▶ Emissions modeling included the following regulations and fuel mixtures:
  - Tier3 NPRM
    - Control of Air Pollution from Motor Vehicles: Tier 3 Motor Vehicle Emission and Fuel Standards Proposed Rule (May 21, 2013)
  - Heavy–duty Greenhouse Gas Rule (HDGHG)
    - Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium– and Heavy–Duty Engines and Vehicles (76 FR 57106, September 15, 2011)
  - Light–duty Greenhouse Gas Rule (LDGHG)
    - 2017 and Later Model Year Light–Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards (77 FR 62623, October 15, 2012)
  - CA LEV3 standards adopted by select states
  - Introduction of E85 into the fuel mixture



## 2018 Onroad (cont.)

- ▶ Projecting vehicle miles traveled (VMT)
  - Used AEO 2013 to project VMT from 2011 to 2018
  - Small number of state/planning organizations provided projected VMT
  - S/L/T–provided VMT took precedence over EPA’s totals and/or vehicle mix
- ▶ California
  - EMFAC–based future emissions
- ▶ Texas
  - TX 2011 NEIv1 submittal was projected to 2018 based on EPA’s modeled changes from 2011–2018



# 2018 Nonroad

- ▶ Emissions from NMIM and NONROAD
- ▶ Starting point was the S/L/T provided inputs for 2011 NEIv1
- ▶ Fuels
  - Based on AEO 2013 projections
  - Includes total fuel use, percentage of renewable fuels, and mix of ethanol blends
- ▶ California
  - Used CARB–provided future nonroad emissions
- ▶ Texas
  - Projected TX 2011 NEIv1 submittal to 2018 based on changes from 2011–2018 in EPA modeling



# Approach to 2018 Non-EGU Projections

- ▶ Includes non-EGU point and nonpoint “NEI-based” source categories
- ▶ Key sources include:
  - Oil and Gas
  - Industrial sources (e.g., cement manufacturing)
  - Agricultural NH<sub>3</sub>
  - Residential wood combustion (RWC)
  - Commercial marine vessels (CMV) and trains
- ▶ Key rules/programs included: Boiler MACT, RICE & cement NESHAPs, regional haze, RFS2/EISA upstream, consent decrees/settlements



# Process for Developing Non-EGU Projections

- ▶ Started with existing set of control programs/ measures and growth assumptions:
  - Evaluated whether programs started/finished by 2011 and target future year (2018)
  - Collaborated to develop updated methodology if needed
  - Regulatory or enforcement changes? (e.g., RICE NESHAP, Boiler MACT, settlements)
- ▶ Inventory analysis:
  - New important source categories?
  - What is “baseline” in NEI usually does not match that of control programs & consent decrees/settlements



# Approach to Non-EGU Projections: Collaboration

- ▶ Coordinated across multiple EPA divisions on many topics
  - RICE, Boiler MACT, cement, oil & gas, refineries
  - Consent decrees/settlements, plant shutdowns
  - Aircraft, CISWI, cement, oil & gas
  - Analysis/initiation w/ other work groups
  - Residential Wood Combustion
- ▶ EPA OTAQ: Renewable Fuel Standard (RFS2) upstream impacts
- ▶ RPOs, regions/states/locals:
  - Comments on base & future year stacks and control programs (e.g., AL, CT, ME, TX, VA)
  - Oil & gas, RWC, settlements, fuel sulfur rules
  - Limited growth assumptions



# Non-EGU Projections: Application hierarchy

Example: Decreasing Priority Top to Bottom							
Comments, settlements	FIPS	Facility	Unit	Stack	Process	SCC	Pollutant
Comments, settlements	FIPS	Facility	Unit	Stack	Process		Pollutant
Comments, settlements	FIPS	Facility	Unit			SCC	Pollutant
Comments, settlements	FIPS	Facility	Unit				Pollutant
Boiler MACT	FIPS	Facility				SCC	Pollutant
Comments, settlements	FIPS	Facility					Pollutant
Cement	FIPS	Facility	Unit			SCC	
RFS Upstream	FIPS	Facility				SCC	
Closures, comments	FIPS	Facility					
RFS Upstream	FIPS					SCC	Pollutant
RICE, RWC, oil & gas						SCC	Pollutant
Aircraft						SCC	





# Non-EGU Projections: What's New?

- ▶ Outreach: public release prior to proposed or final rulemaking
- ▶ Oil and Gas production w/ limited NSPS
- ▶ Updated ISIS-based methodology for cement manufacturing
- ▶ Numerous state comments on future-year controls/emissions prior to first future-year inventory/AQM
- ▶ Regional haze controls and new information on recent consent decrees
- ▶ Residential Wood Combustion (RWC)
- ▶ Airport-specific projections
- ▶ Emission Inventory System (EIS)-based closures information



# Oil & Gas Projections

- ▶ Based on estimated Annual Energy Outlook (AEO) 2013 using regional 2011–2018 growth factors
  - Oil production, natural gas production, and combined oil & natural gas activities
  - Energy Information Administration county–NEMS (National Energy Modeling System) region cross–walk
- ▶ For sources impacted by NSPS, verified with EPA program leads:
  - Reduction factors estimated from Climate Action Report
  - Assumed NSPS impacts VOC only and reduces increases only (new activities in the future)
  - Natural gas well completion–related activities are “one–shot”, so all emissions reduced, not just “growth”

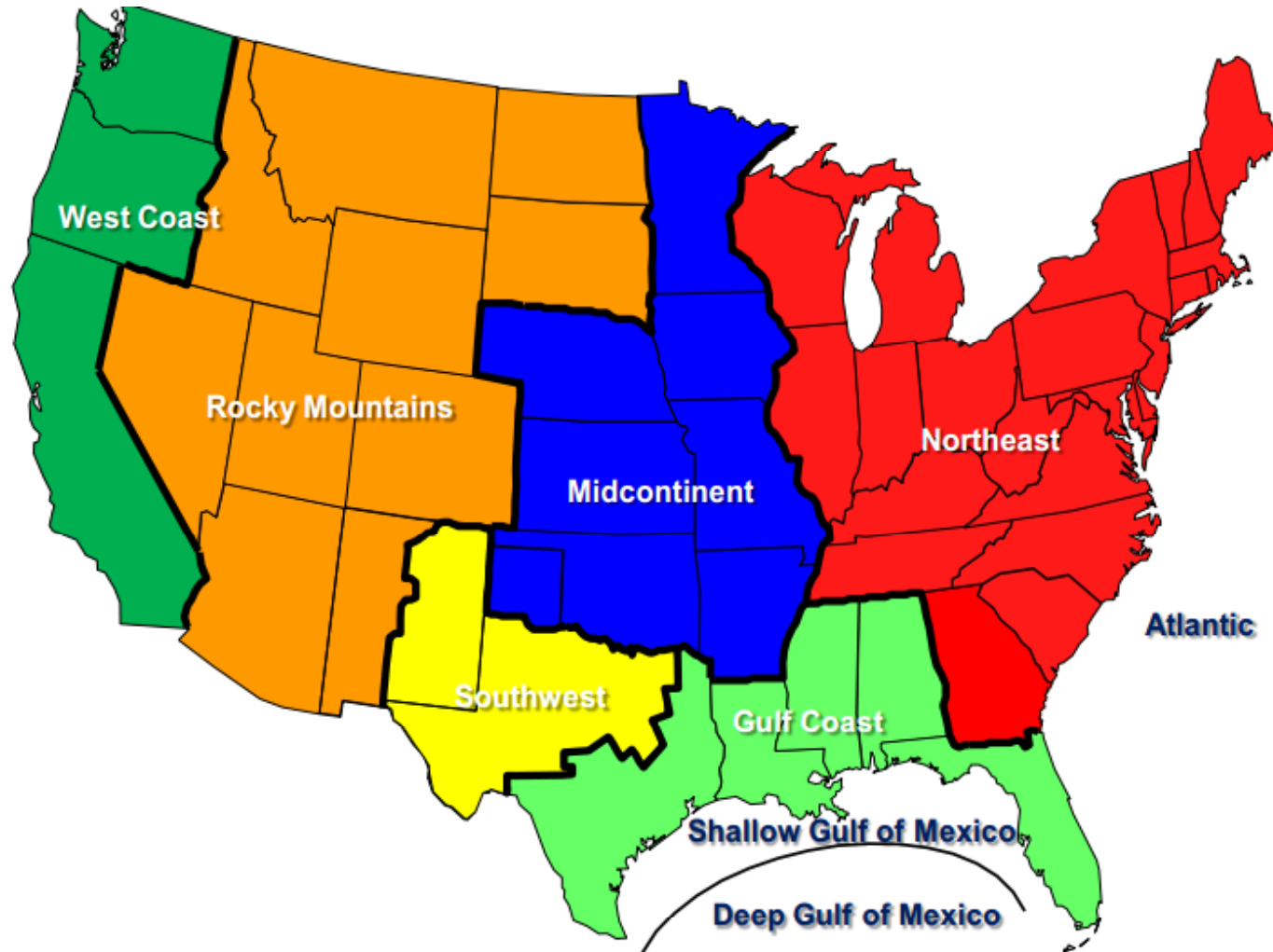


## Oil & Gas Projections (cont.)

- ▶ Net growth rates computed from AEO growth + NSPS controls (VOC only) + other assumptions:
  - No replacement of capital via NSPS, only affects growth
  - Emissions change linearly with production level changes
  - Engine-related regulatory impacts (RICE NESHAP) calculated separately



# Oil & Gas NEMS Regions

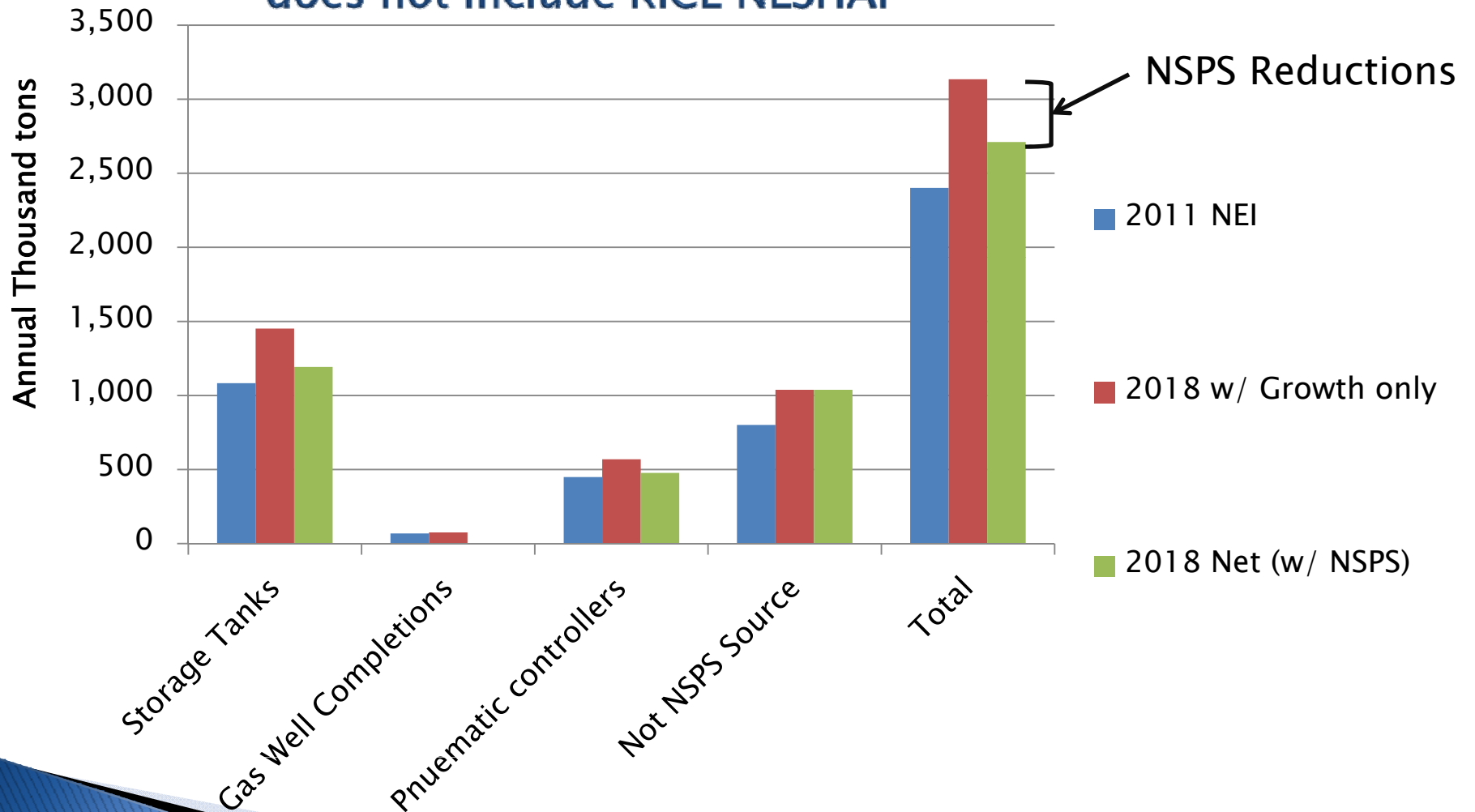


Source: U.S. Energy Information Administration, Office of Energy Analysis.



# Oil & Gas VOC Draft Projection Estimates

\*\* does not include RICE NESHP





# Cement Manufacturing

- ▶ Industrial Sectors Integrated Solutions (ISIS) model (Aug 2013 version) projects cement kilns from 2011 to 2015–2030 for most CAPs, HCL and Hg
- ▶ Portland Cement Association (PCA) plant information summary from 12/31/10
- ▶ July 2012 outlook using 2011 NEI and 2015 NESHAP controls
  - Production increases 65% from 2011 (71M tons) to 2018 (117M tons)
  - But NO<sub>x</sub> only increases 46% and SO<sub>2</sub> decreases 13% and PM decreases 74%
- ▶ Updated approach:
  - treatment of ISIS-generated new kilns as nonpoint sources
  - Projections applied at state-level rather than kiln level + QA
  - Permitted new kilns still treated as point sources
- ▶ Reconciliation with state comments and/or quantifiable consent decrees/settlement information



# Residential Wood Combustion

- ▶ Factors by Source Classification Code (SCC) for PM<sub>2.5</sub>, VOC and CO through 2035
- ▶ 3 options:
  - BAU (business as usual)
  - Draft proposed NSPS (2-step)
  - Alternative NSPS (3-step)
- ▶ Going with BAU –standard practice
  - Growth based on 2012 shipments (Frost & Sullivan) by appliance type
  - For certified wood stoves, pellet stoves, indoor furnaces & hydronic heaters, assumes correlated w/ revenue growth 2013–2035 (GDP via US BEA) ~2%/yr
    - Modest replacement rates assumed for these appliance types, similar to 2007 platform assumptions
  - Fireplaces, outdoor firelogs/chimneas based on 2002–2012 national number of houses ~1%; no replacement assumed
- ▶ Special procedure under development for CA, OR and WA likely involves “no net growth” in RWC



# Non-EGU Projections:

## Limitations and Areas for Future Improvement

- ▶ Need more existing control information in the base year NEI data
- ▶ States/locals review: consent decrees, settlements, “local” knowledge (e.g., units switching fuels or closing)
- ▶ Oil & gas w/ NSPS, speciation/spatial/temporal?
- ▶ Revisit high-impact rules such as Boiler MACT, ULSD
- ▶ Industrial non-EGU sources, overall lack of projection method
- ▶ Canada emissions are year 2006
- ▶ Mexico emissions are 2018 but projected from 1999 inventory (MNEI).
- ▶ RWC “BAU” approach vs NSPS options, burn bans & local base and future year AQM inventories
- ▶ Upstream RFS2 impacts
- ▶ Commercial Marine Vessel (CMV), particularly C3 data based on pre-Great Recession projections





# Overall 2018 Projections: Next Steps

- ▶ Summarize 2018 impacts and develop public TSD
- ▶ Public outreach, particularly to states and RPOs for additional data
- ▶ Gather preliminary comments/data for next set of projections (2018 or possibly other regulatory effort)
- ▶ Ultimately, develop an updated version of the 2011 platform with 2018 projections for final rule-makings



# Public Release of 2018 Projected Emissions

- ▶ Federal Register Notice and docket expected by early January
- ▶ Reports similar to those developed for 2011 will be developed for 2018, along with reports relevant to projections
- ▶ Year 2011 to 2018 emissions summaries showing impacts of base and future year & summaries of CLOSURE, CONTROL and PROJECTION packets will be included
- ▶ Data release will include a full set of non-EGU point, nonpoint (including CMV & trains) CLOSURE, CONTROL and PROJECTION packets
- ▶ Documentation of the platforms will be provided, including descriptions of the projection packets and approaches
- ▶ Reports that are sufficiently small will be uploaded to docket
- ▶ EPA posts emissions platform data, including projections, on the CHIEF Emissions Modeling Clearinghouse
  - <http://www.epa.gov/ttn/chief/emch>