



# **WRAP Activities and Regional Transport/Source Apportionment Issues**

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WRAP/Western Governors' Association

Pima Association of Governments' Air Quality Forum  
Tucson, AZ - June 10, 2010

## Thanks to:

- Lee Comrie and PAG
- WRAP members and staff
- Past and present air quality colleagues in Arizona
- Darrell Winner and colleagues at EPA ORD

## Topics today:

- WRAP activities
- Regional air quality and emissions
- Integrating effects of climate change into air quality planning

# Former WRAP Charter & Board Structure

- Chartered in 1997
- Focus primarily on regional haze, including implementation of Grand Canyon Visibility Transport Commission recommendations
- Other air quality issues “as requested by the membership”
- Large, high-level Board – up to 31 members
  - Governors, Tribal Leaders, Agriculture/Interior Secretaries – EPA ex officio
  - 14 states, up to 14 tribes
  - USFS, NPS, FWS, EPA
- Highly structured Technical and Policy oversight with members from state, tribal, federal, industry, and environmental communities
  - Most committees have completed work and are inactive
- *Time for a change* –
- [Comparison of old and new WRAP charters](#)

# New WRAP Charter

- Multiple drafts July through October 2009
- Review and approval by former WRAP Board completed December 2009
  - [http://www.wrapair2.org/Revised\\_WRAP\\_Charter\\_approved\\_December\\_2009.pdf](http://www.wrapair2.org/Revised_WRAP_Charter_approved_December_2009.pdf)
- New Board seated February 2010
- Compared to past WRAP efforts, 2010 activities will be limited because of resources as WRAP members identify and plan work to be done under new Charter
- New website ([www.wrapair2.org](http://www.wrapair2.org))
  - Old WRAP site archived and accessible (all links work!)

# *New WRAP Charter - Purpose*

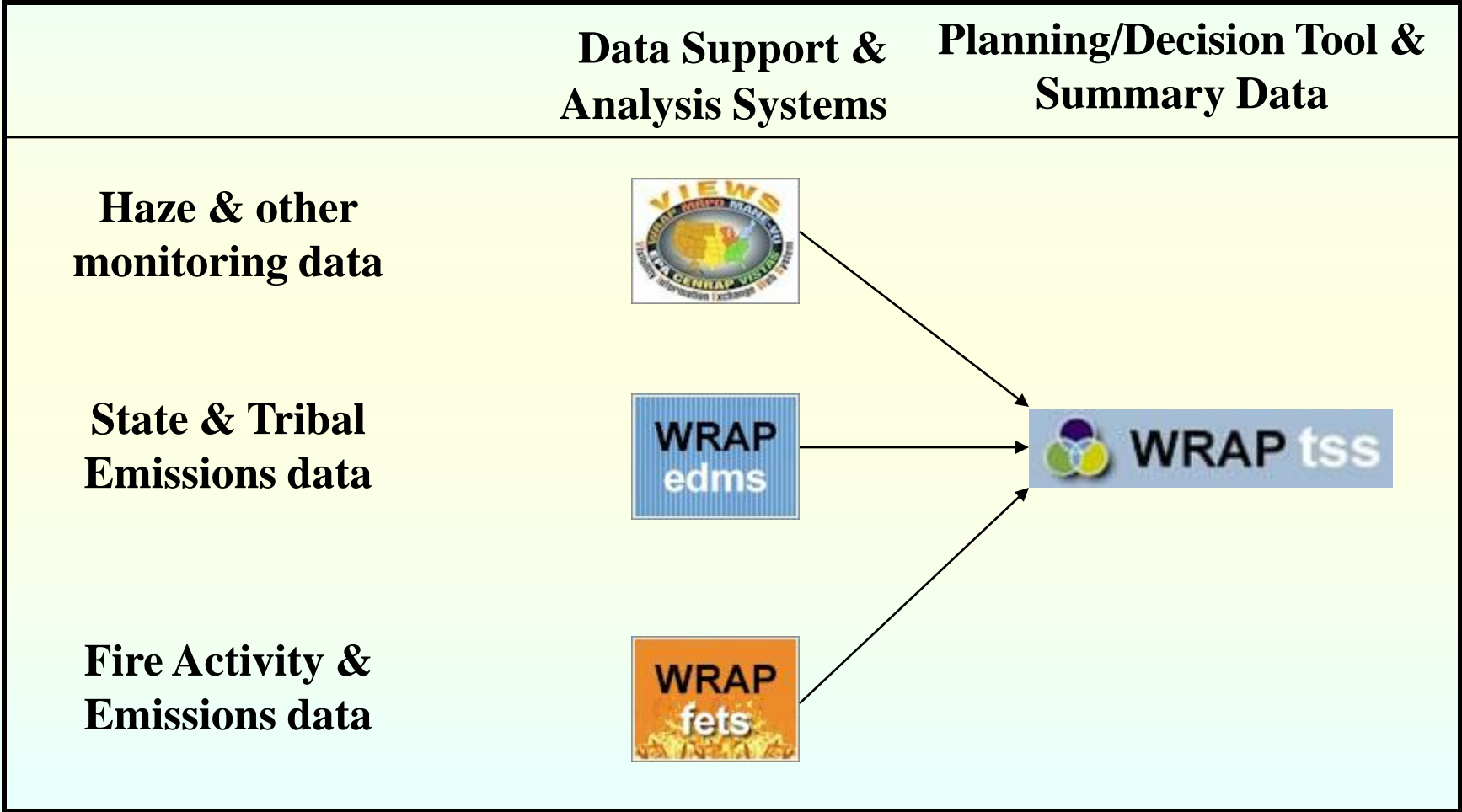
The WRAP provides a venue for Western states, tribes, local governments, federal land managers and the USEPA to:

- 1) **maintain and update the regional haze work** that WRAP has developed and continue to make the data and tools available for states and tribes to use as they implement their regional haze SIPs;
- 2) **develop a common understanding of current and evolving regional air quality issues in the West**, such as regional haze, ozone, fine and coarse particulate matter, nitrogen deposition and critical loads, and mercury and other hazardous air pollutants;
- 3) **examine and discuss Western regional air quality issues from a multi-pollutant perspective**;
- 4) **develop and maintain regional databases that support regional and sub-regional technical analyses**. This includes collection and analysis of data from various sources to produce regionally consistent, comparable, complete, and transparent results, able to be utilized and relied upon by individual jurisdictions and agencies;

## *New WRAP Charter Purpose, continued*

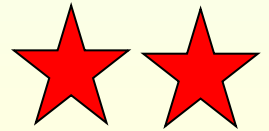
- 5) **collaborate with USEPA to ensure that, to the maximum extent possible,** WRAP data and analyses are compatible with and leverage work conducted at the national level. This could include WRAP work to compile data and analyses related to international, off-shore, and other sources of air pollution affecting Western air quality;
- 6) **evaluate the air quality impacts associated with regionally significant emission sources,** such as mobile sources, fire, traditional and alternative energy development/extraction, windblown dust, and electricity generation, and, as warranted, to discuss regional and cross-jurisdictional strategies to improve air quality and mitigate the impacts from such sources;
- 7) **consult with air quality agencies in other regions** to prevent duplication of effort and enhance efficiency and consistency of databases and analyses;
- 8) **evaluate how the impacts of climate change may affect air quality in the West;** and
- 9) **as requested by the membership, formulate and advance Western regional air quality policy positions on air quality.**

**2010 WRAP Activities:** maintain & operate web data systems to support haze planning/implementation, transition to multi-pollutant analysis



# Key issues from WRAP Santa Fe (11/09) & Denver (03/10) meetings

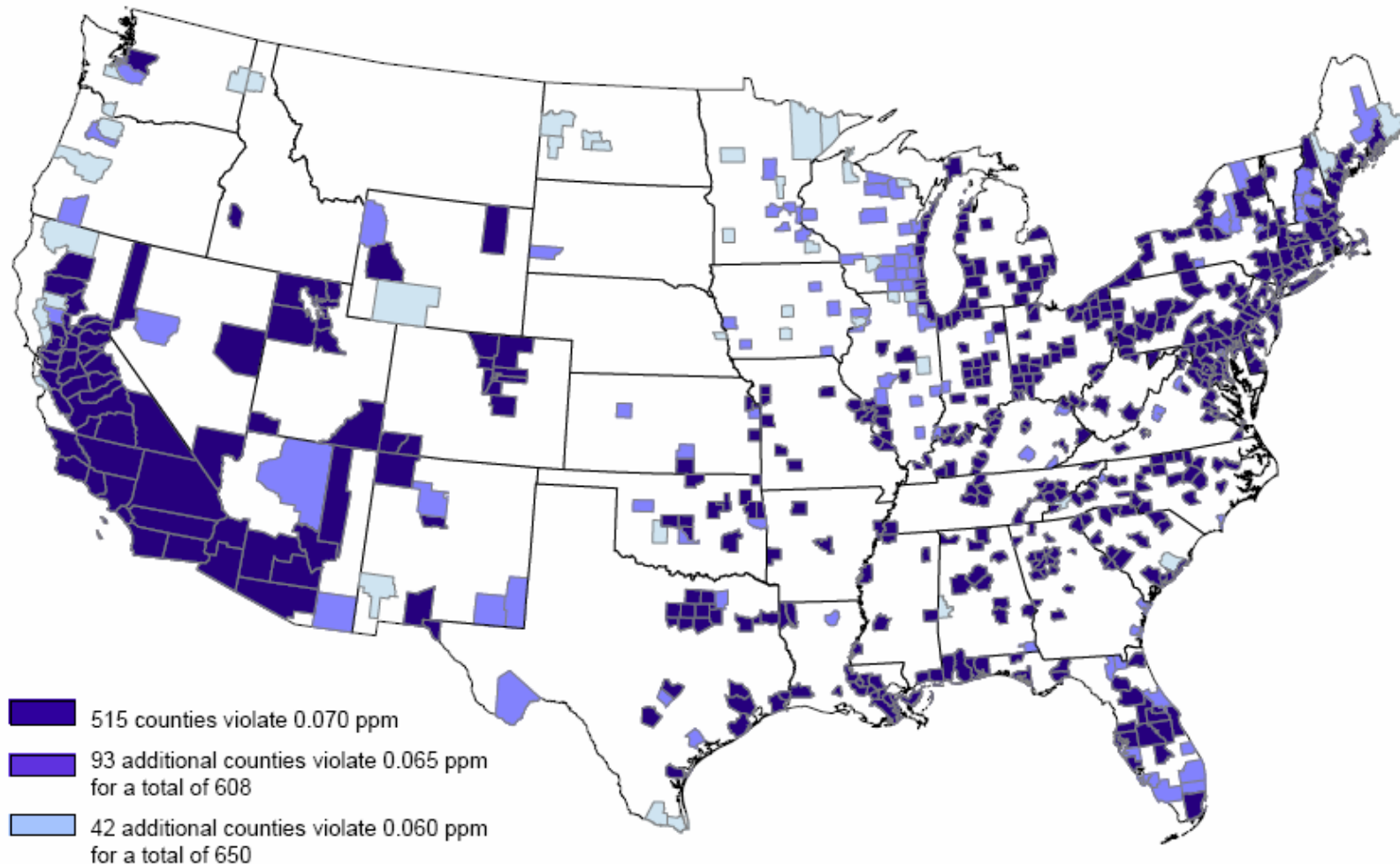
- Multiple EPA standards in review, most likely to change or be added:
  - Ozone health standard level
  - Separate Ozone secondary welfare standard
  - 1-hour NO<sub>2</sub> health added
  - NO<sub>x</sub>/SO<sub>2</sub> combined secondary welfare (deposition)
  - PM<sub>2.5</sub> and PM<sub>10</sub> health
  - Separate PM welfare (light extinction)
  - SO<sub>2</sub> health



# Counties With Monitors Violating Proposed Primary 8-hour Ground-level Ozone Standards 0.060 - 0.070 parts per million

(Based on 2006 – 2008 Air Quality Data)

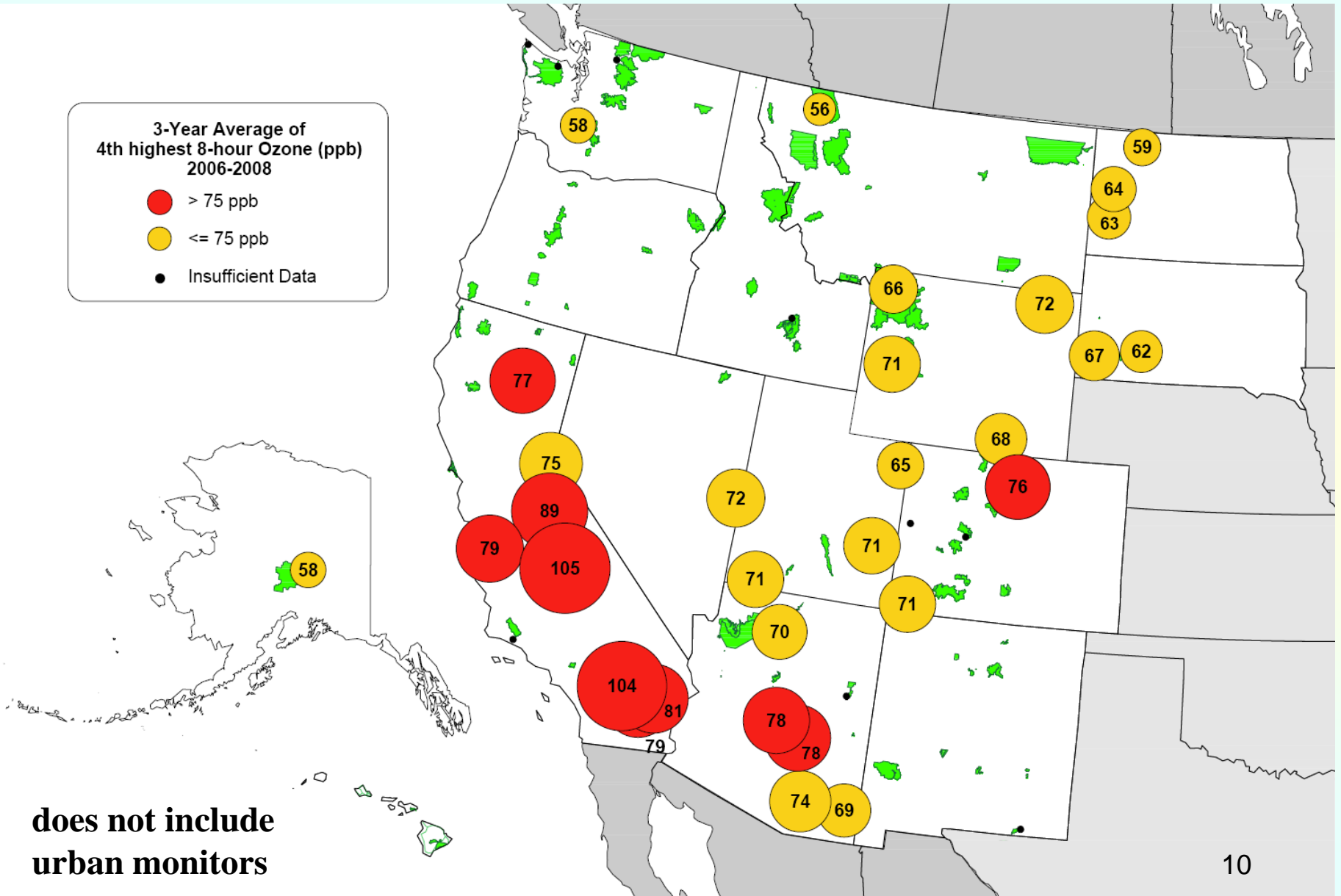
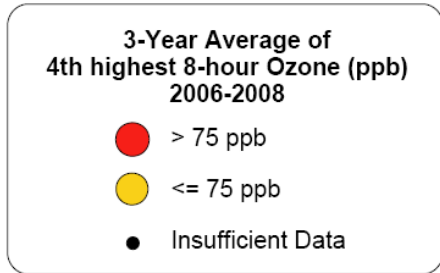
EPA will not designate areas as nonattainment on these data, but likely on 2008 – 2010 data which are expected to show improved air quality.



## Notes:

1. No monitored counties outside the continental U.S. violate.
2. EPA is proposing to determine compliance with a revised primary ozone standard by rounding the 3-year average to three decimal places.

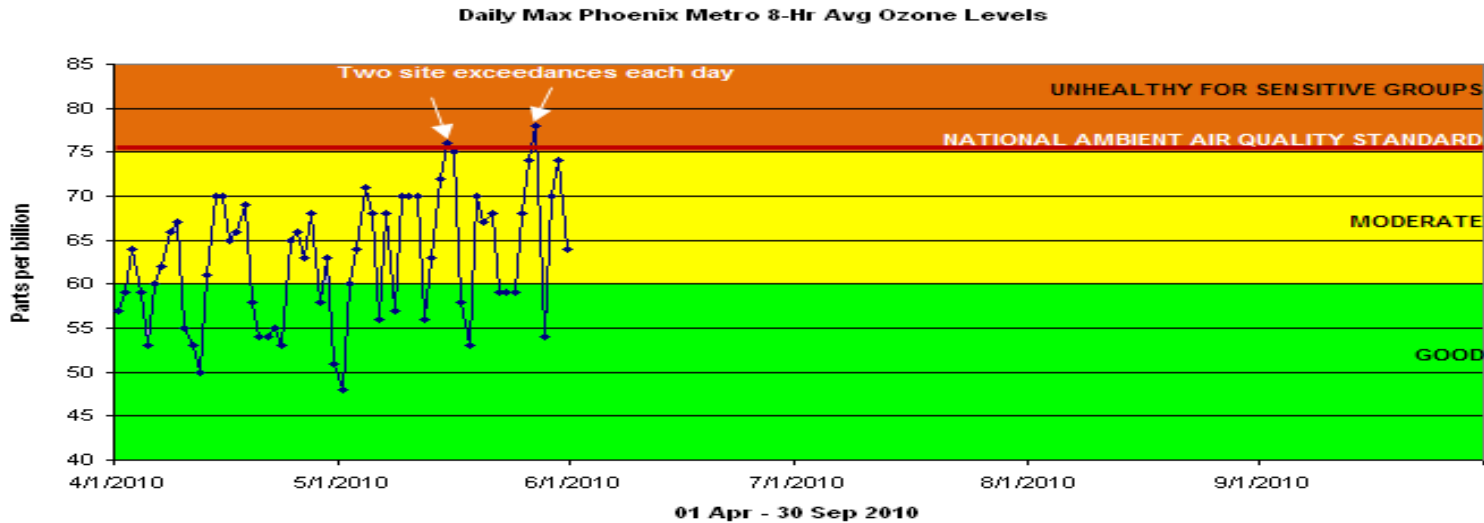
**2006-08 3-year average of 4<sup>th</sup> highest daily monitored max 8-hr average at rural/Class I sites**



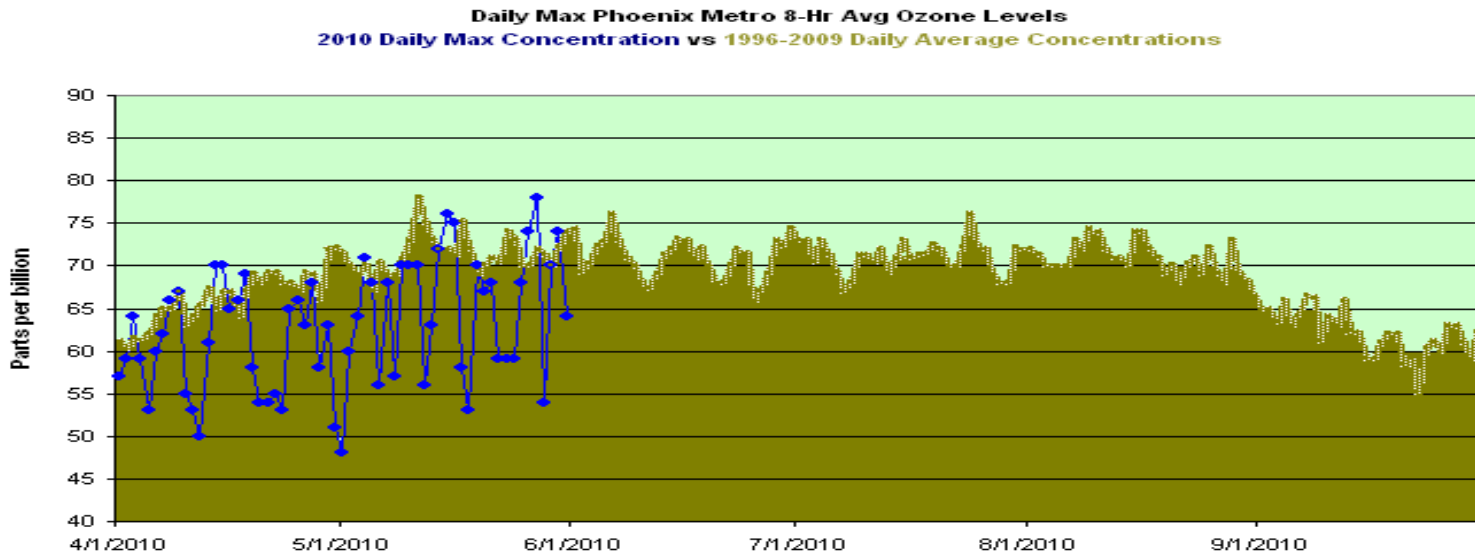




Phoenix metro area 2010 daily maximum to date – note # of values above 75, 70, and 65 ppb.

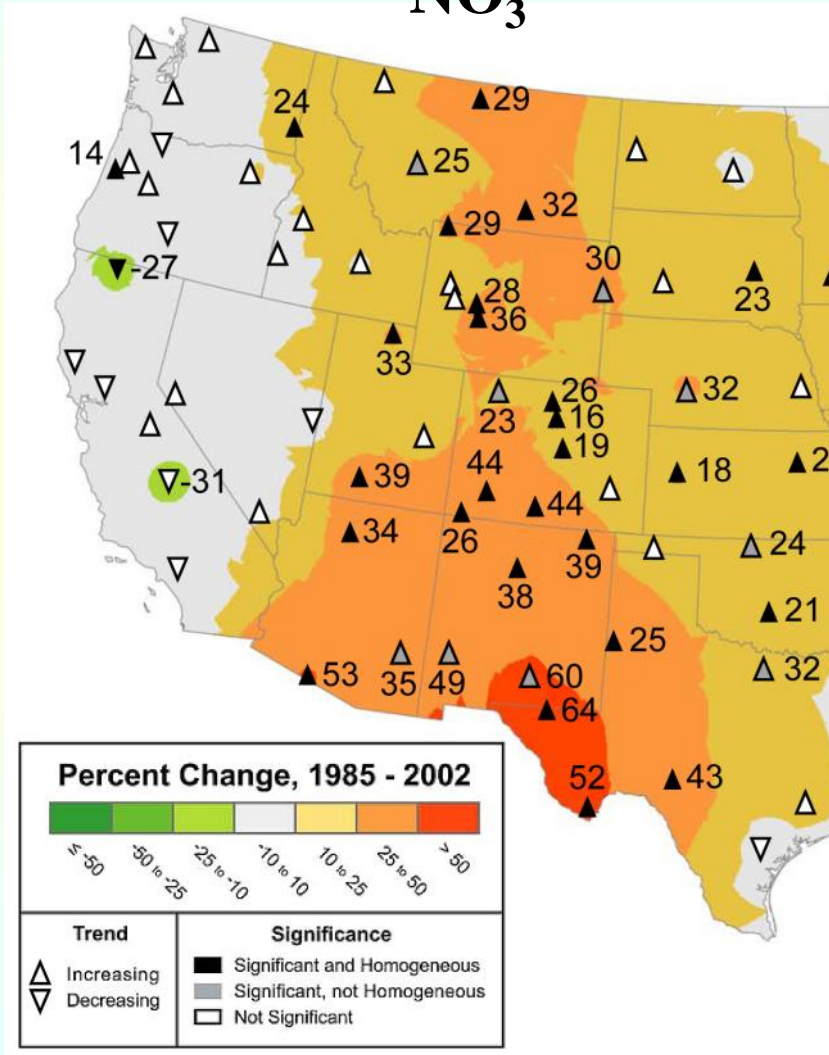


Comparing longer-term daily max averages to the 2010 daily variation - is the Ozone NAAQS compliance period, in terms of the "probability of repeated exposure to elevated ozone", is captured well by a 3-year window? What is the best way to plan to reduce Ozone?

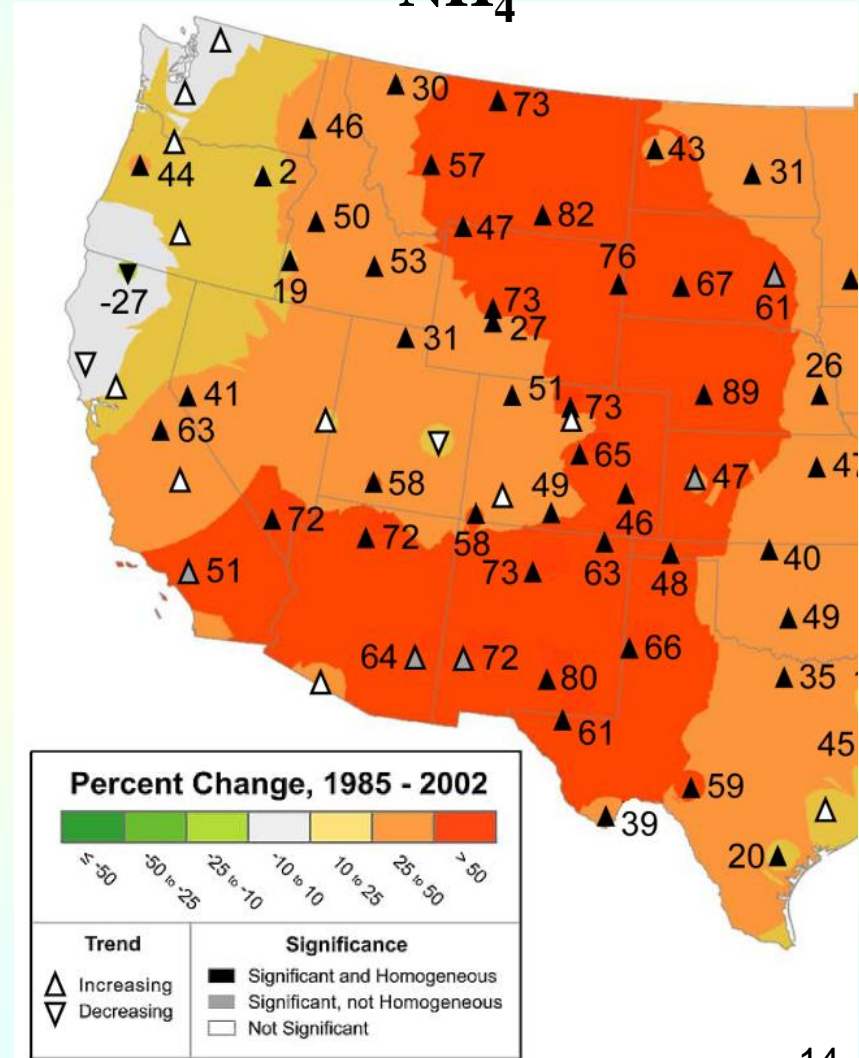


# Regional precipitation N trends

$\text{NO}_3^-$



$\text{NH}_4^+$



# Regional technical Analyses for new/revised NAAQS

Western air quality agencies will need to address:

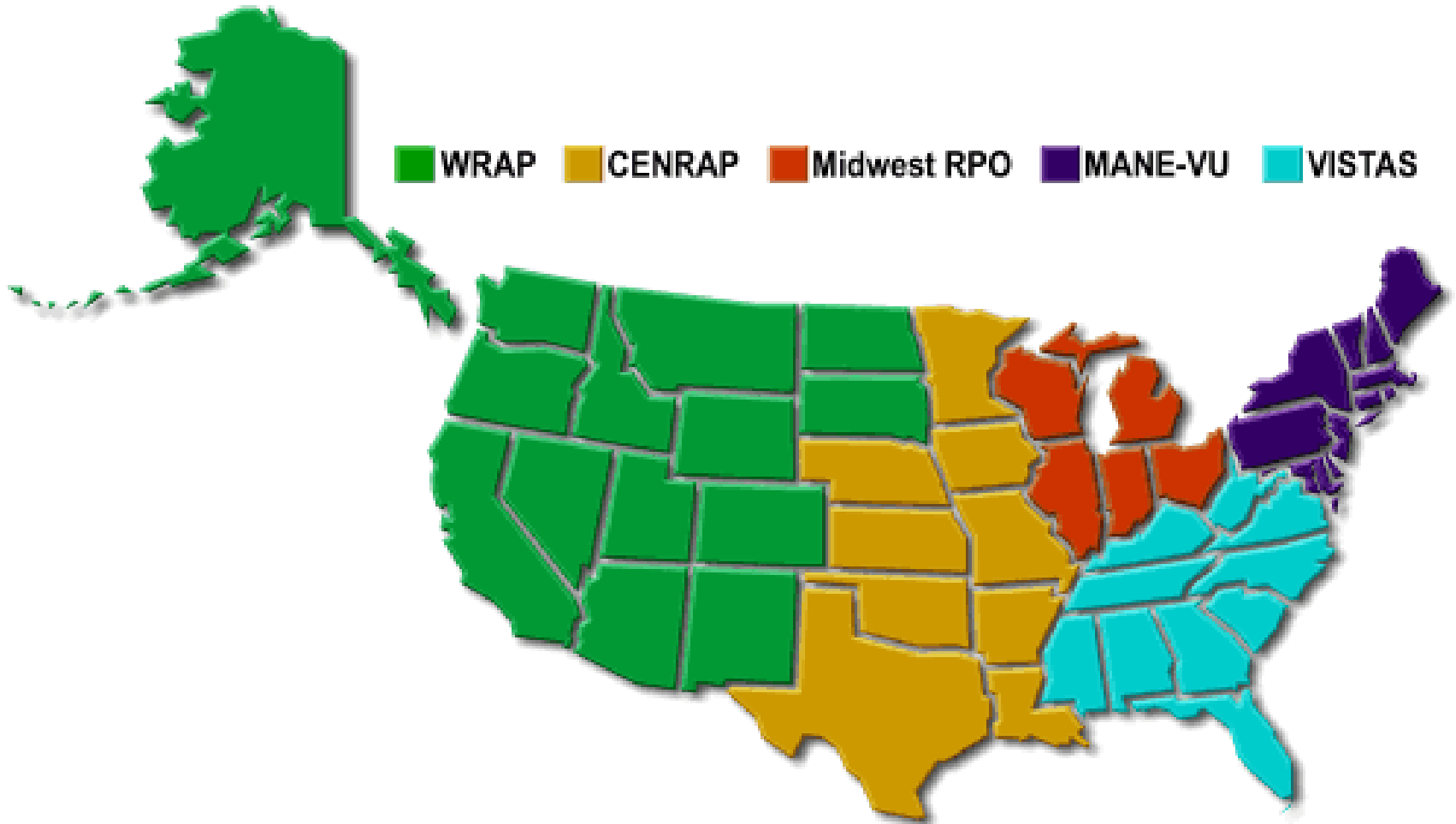
- Effects of new/revised NAAQS(s)
  - Nonattainment findings for one or more NAAQS, and the required AQ planning will be closely spaced in time (*the CARB experience?!*)
  - More stringent NAAQS suggest greater regional contribution
  - Likely to be many new Western nonattainment areas, a significant number of which will be Class I areas and large rural counties/CMSAs
    - **More frequent and numerous air quality events thought to be “exceptional”**

# Regional technical Analyses for new/revised NAAQS

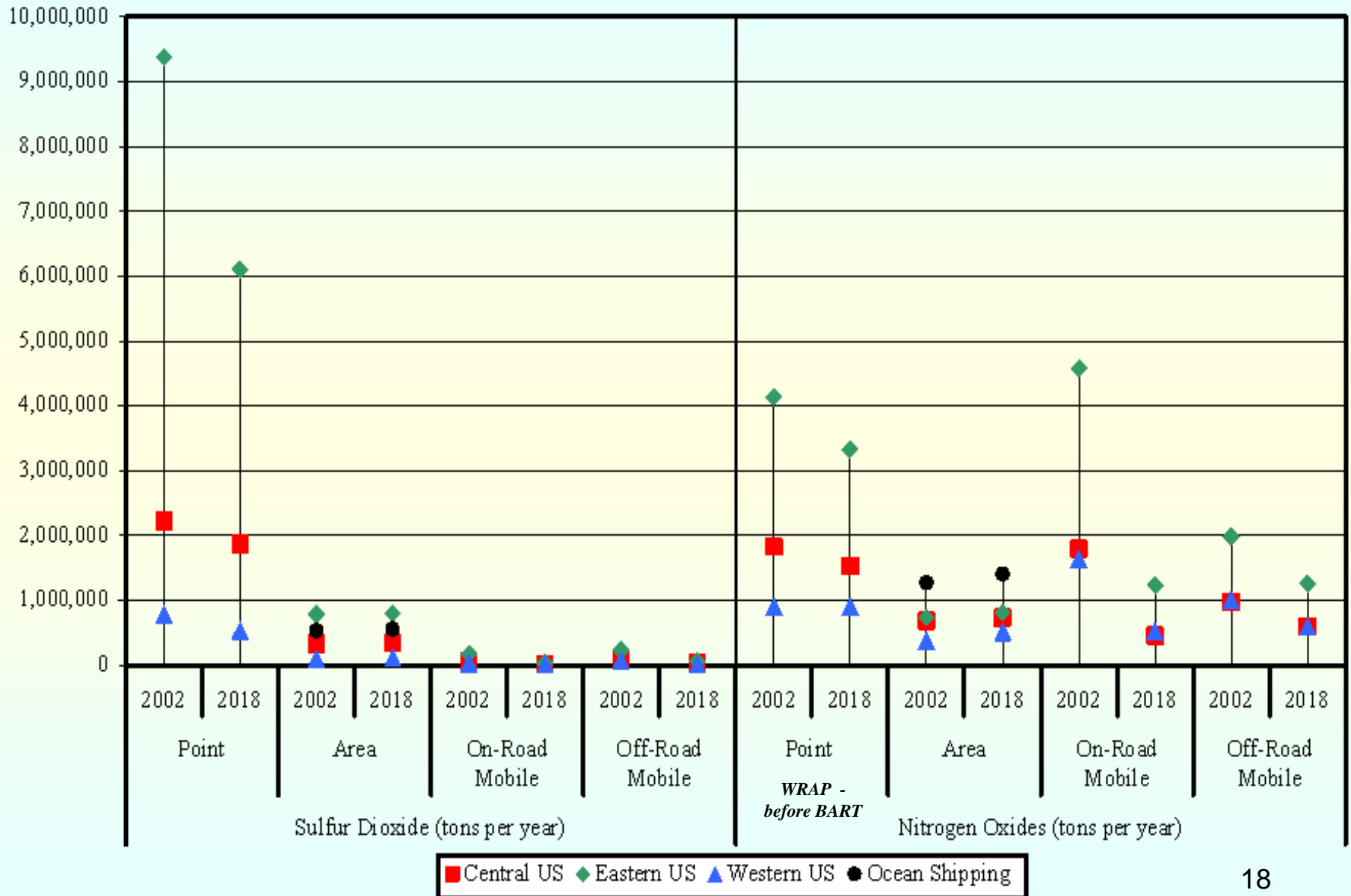
Western air quality agencies will need to address:

- Analyses for CAA Planning (*to support those “SIP deliverable” requirements listed by others*)
  - Timing of planning/control strategy development for multiple standards
  - Defining the various time/space/emissions scales of the impacts to the standards and contributing sources (*opportunity for multi-pollutant and multi-jurisdictional analysis and planning!*)
    - **Sources and regions will combine in many different regional transport contributions**
  - Needs for local, sub-regional, and West-wide technical support

***Big Picture*** - North American Emissions Inventory Regions:  
WRAP, CENRAP, Eastern US, Canada, Mexico, and Pacific  
Off-Shore Shipping (base year 2002, projection year 2018)

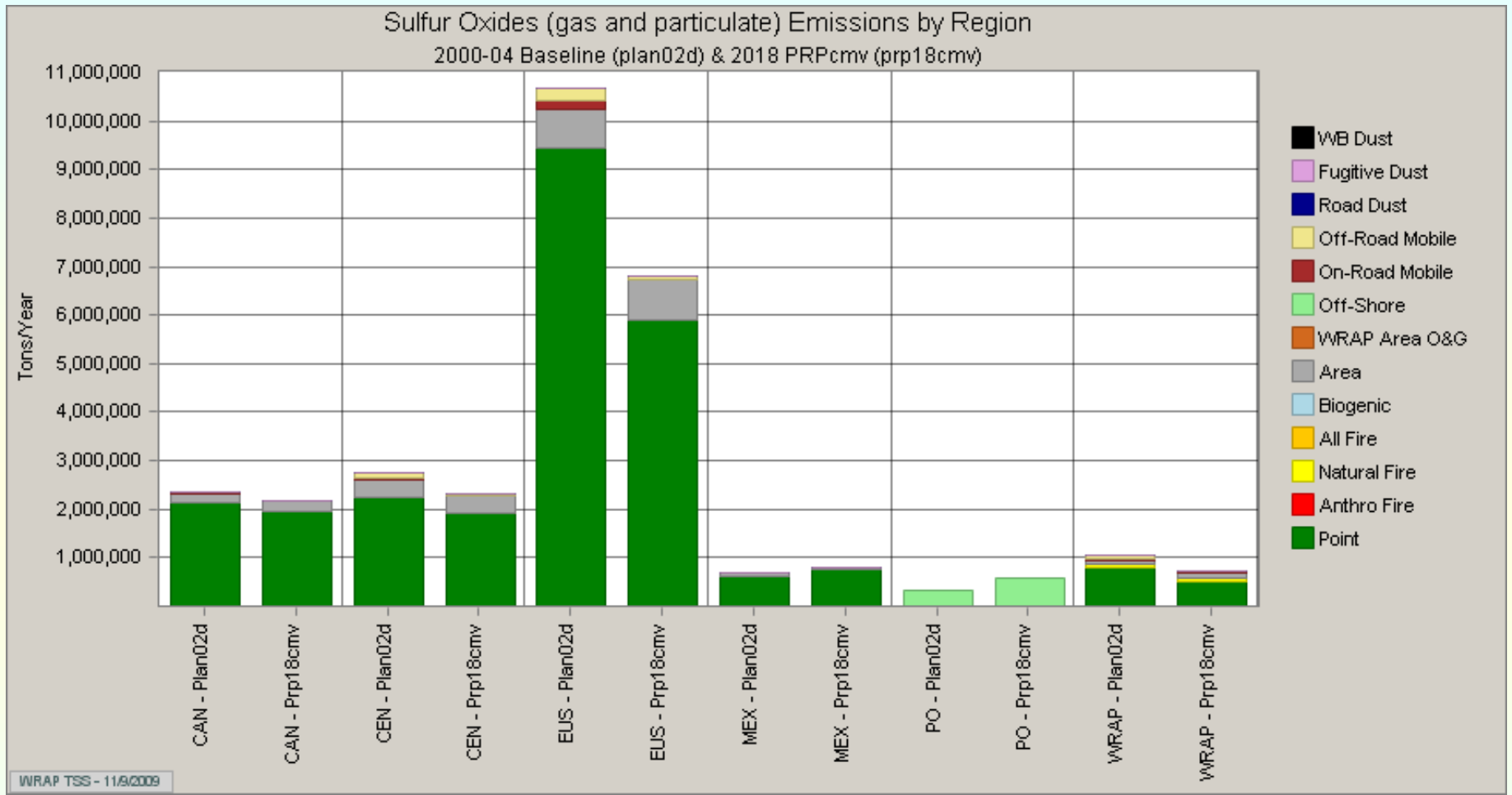


## U.S. Regional Emissions Changes 2002-18



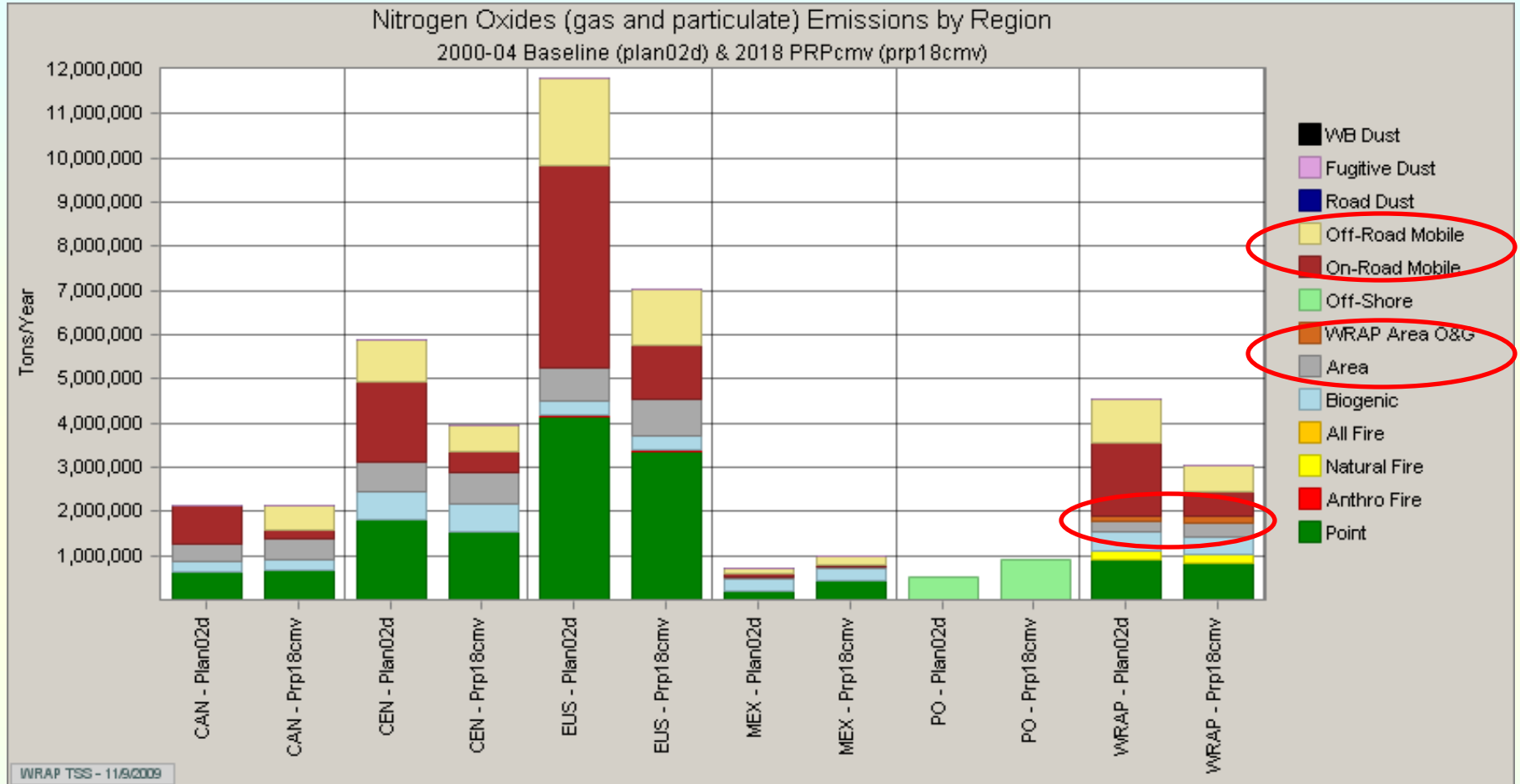


# Change in SO2 Emissions (tpy) 2002 to 2018 across North America



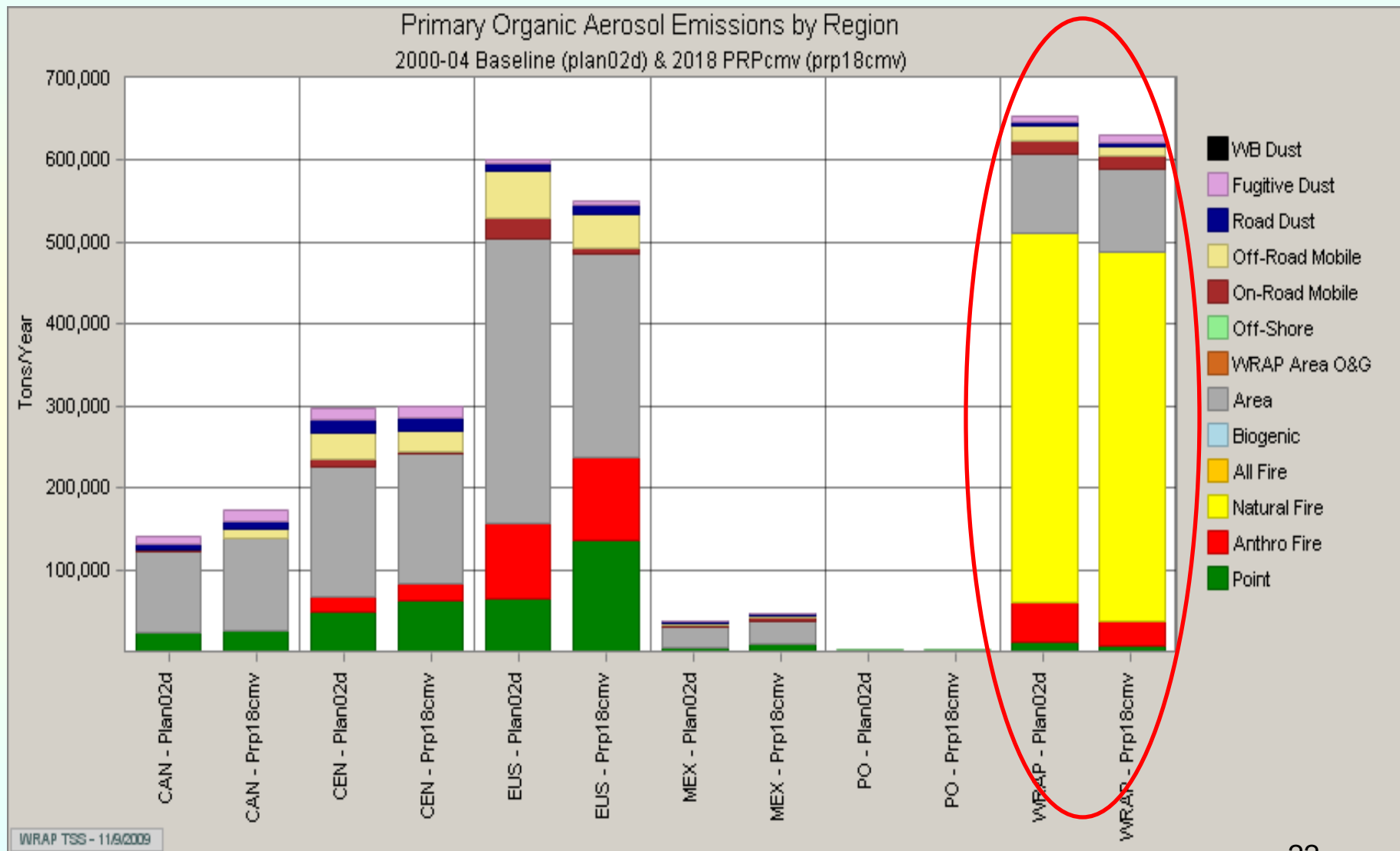
All SO <sub>2</sub> Sources 2002 to 2018	Canada	CENRAP	Eastern US	Mexico	Pacific Off-Shore	WRAP
Tons/year	-159,003	-445,526	-3,856,861	+99,105	+273,413	-341,348
%	-7%	-16%	-36%	+14%	+88%	-32%

# Change in NO<sub>x</sub> Emissions (tpy) 2002 to 2018 across North America



All NO <sub>x</sub> Sources 2002 to 2018	Canada	CENRAP	Eastern US	Mexico	Pacific Off-Shore	WRAP
Tons/year	-17,043	-1,947,438	-4,765,494	+280,697	+391,972	-1,518,746
%	-1%	-33%	-40%	+39%	+76%	-33%

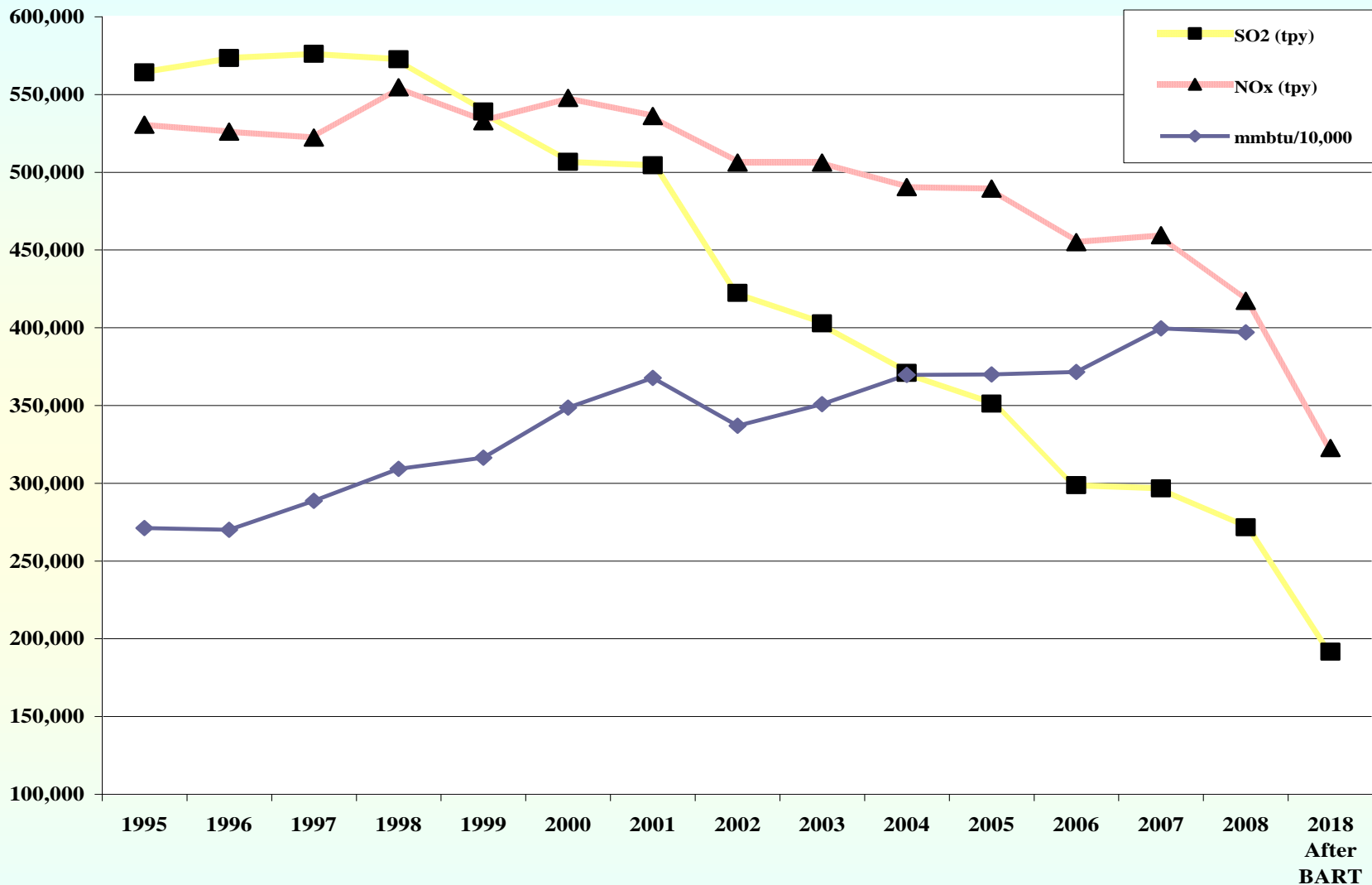
# Change in Primary Organic PM2.5 Emissions (tpy) 2002 to 2018 across North America



# Western U.S. Emissions

- Down ↓
  - Power plants & other industrial point sources
  - Mobile
  - Prescribed Fire
- Up ↑
  - Pacific Off-Shore Shipping
  - Dairy Farms
    - 1970 (national average of 19 cows/farm)
    - By 2007, the average Western dairy has 550 cows (about 5 times the 2007 national average)
    - About 80 Western dairies now each have at least 5,000 cows
  - Oil & Gas
- 2002 WRAP region emissions inventories used as starting point for many sub-regional studies

## Western State Power Plant Emissions\* (1995-2008) and After BART\*\*



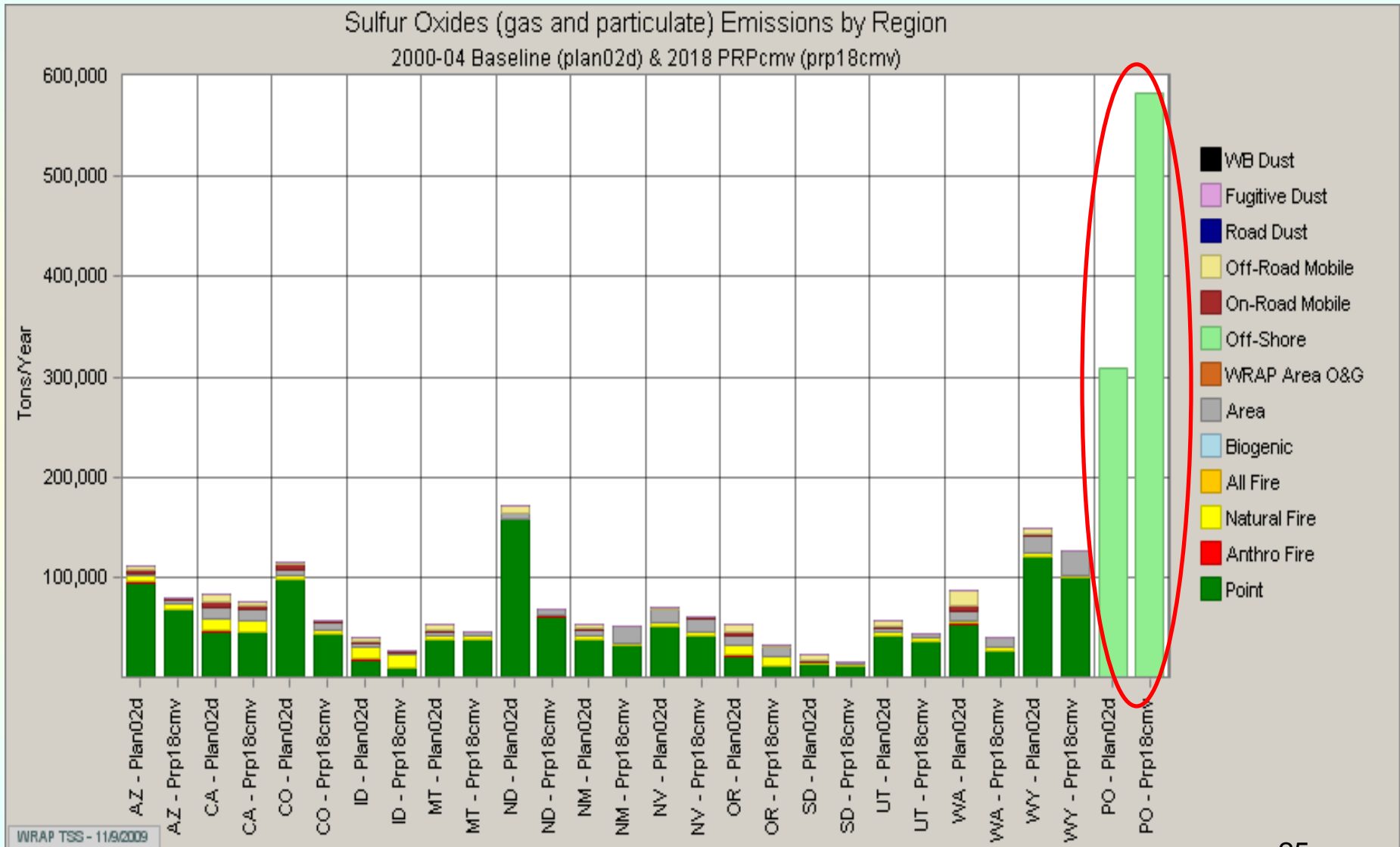
\* Currently operating coal, gas, and fuel oil-fired plants in the 11-state Western Interconnection

\*\* Estimates for BART controls are from WRAP PRP18b emissions analysis (as of Spring 2009) at:

<http://www.wrapair.org/forums/ssjf/pivot.html>

# Change in WRAP region SO<sub>2</sub> Emissions (tpy) 2002 to 2018

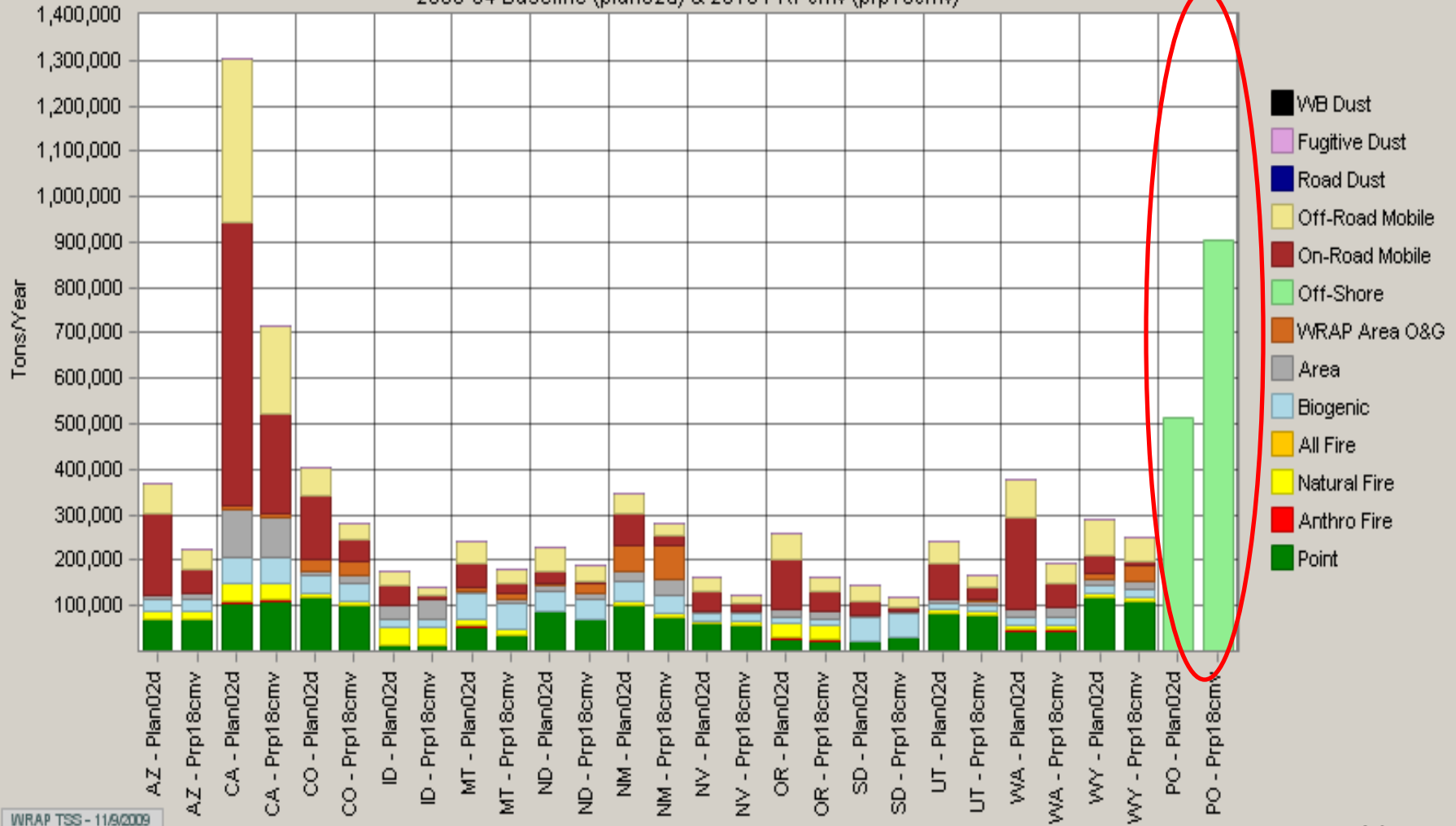
*Point sources down 269,675 tons (-34%), Mobile down 91,147 tons (-83%)*



# Change in WRAP region NOx Emissions (tpy) 2002 to 2018

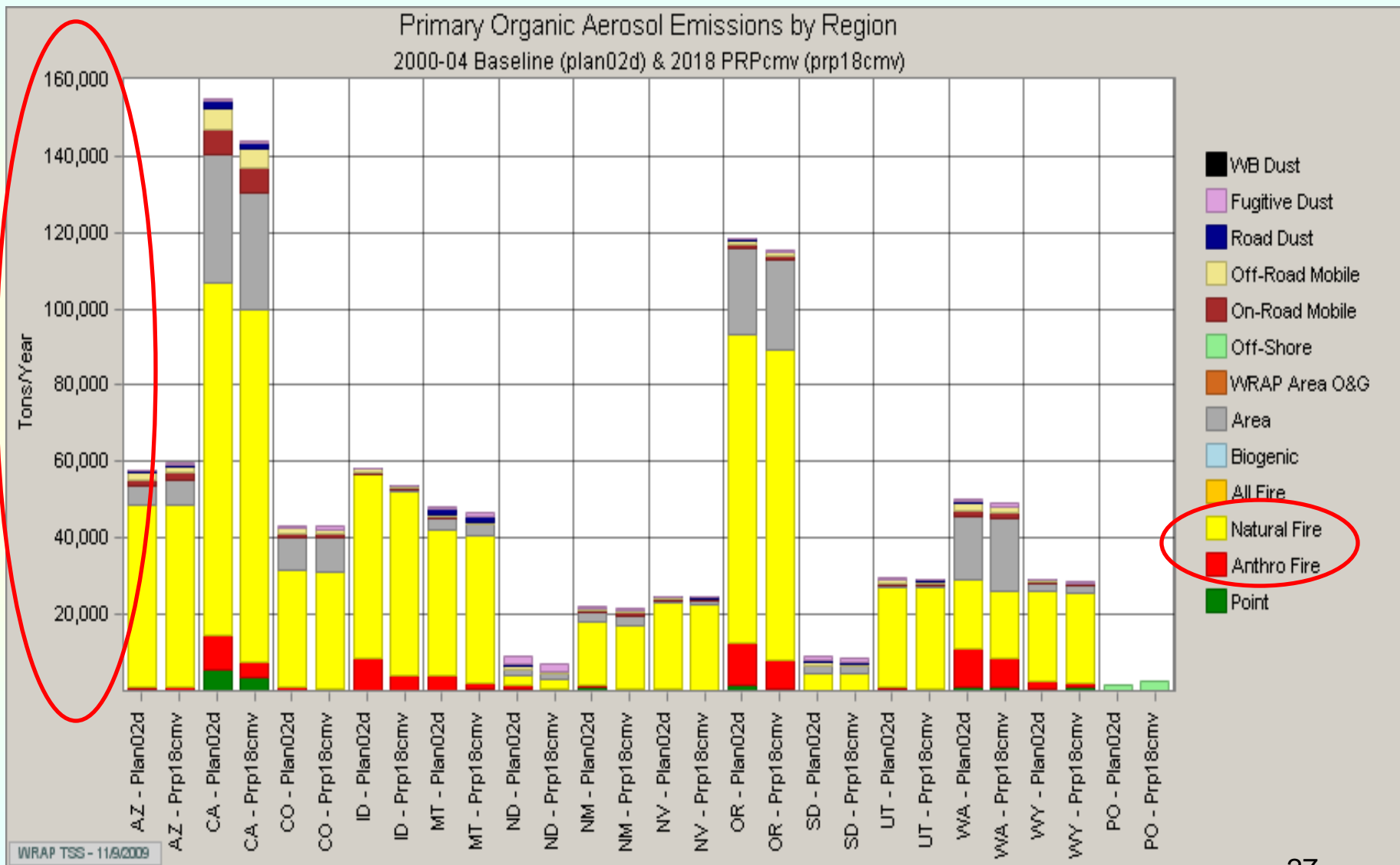
*Point sources down 87,157 tons (-10%), Mobile down 1,524,975 tons (-58%)*

Nitrogen Oxides (gas and particulate) Emissions by Region  
2000-04 Baseline (plan02d) & 2018 PRPcmv (prp18cmv)



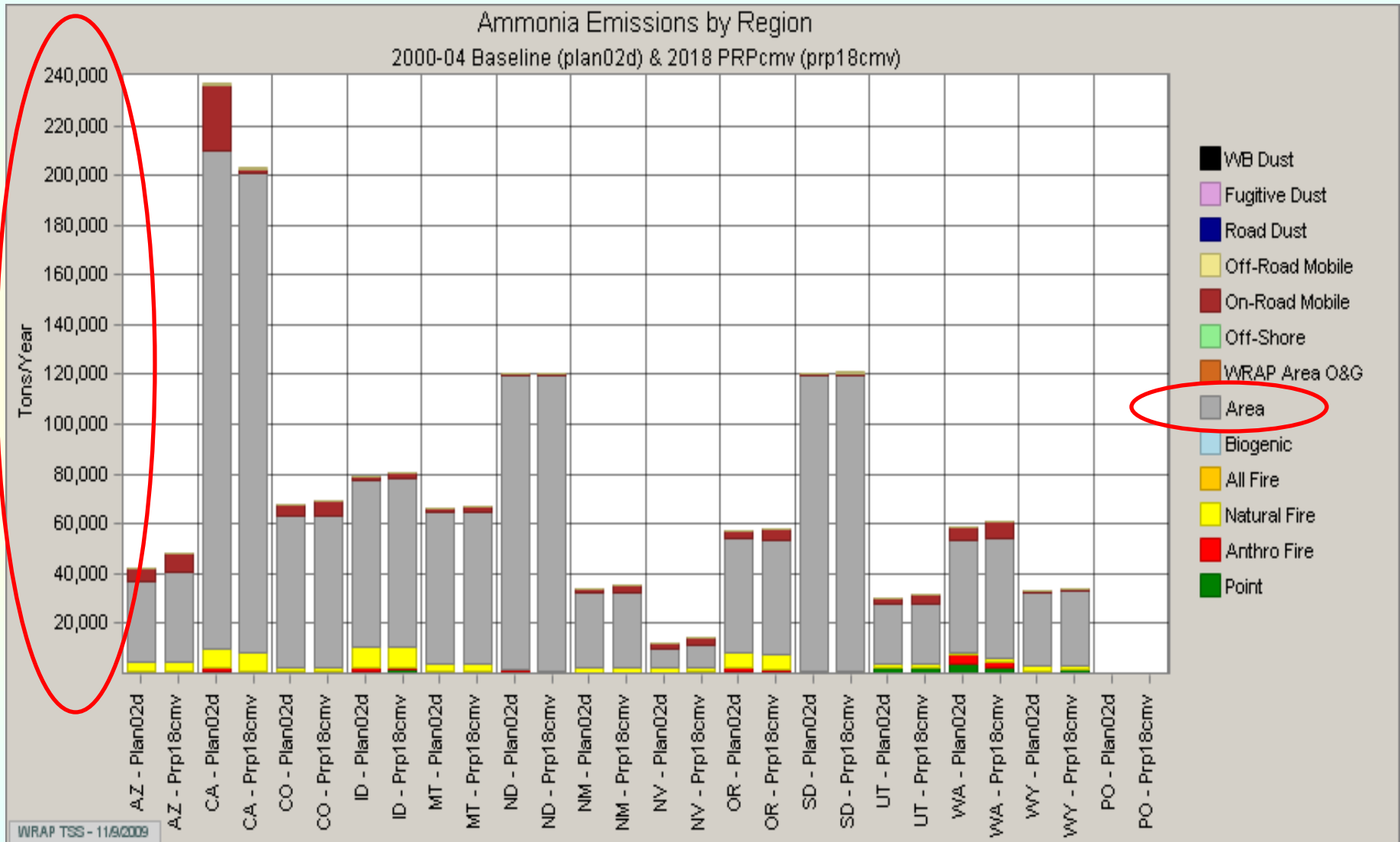
# Change in WRAP region Primary Organic PM2.5 Emissions (tpy) 2002 to 2018

*Point sources down 3,181 tons (-30%), Mobile down 5,669 tons (-17%), Rx Fire down 19,945 tons (-17%)*



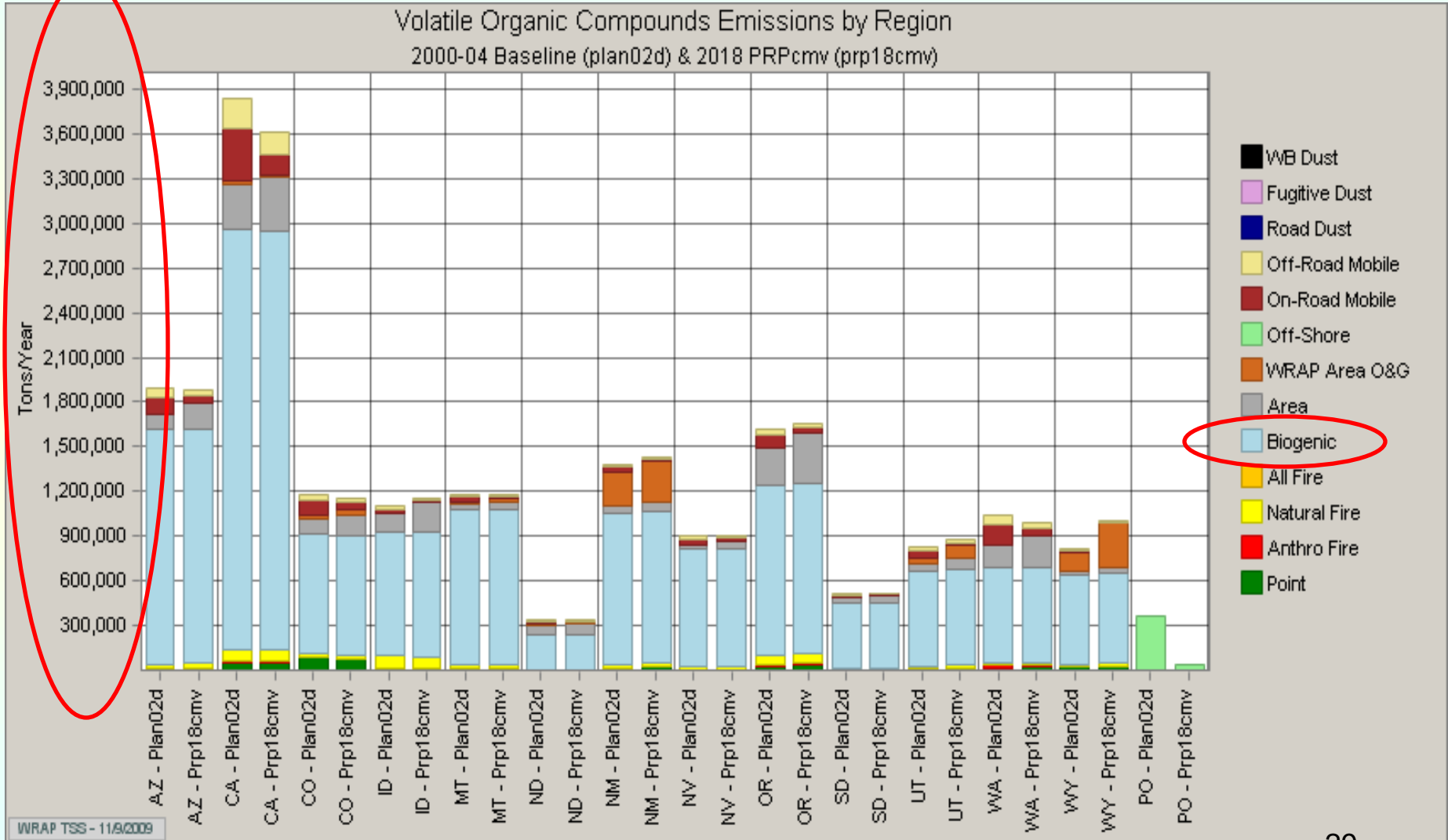
# Change in WRAP region Ammonia Emissions (tpy) 2002 to 2018

*Mobile down 12,098 tons (-21%), Rx Fire down 3,943 tons (-43%)*



# Change in WRAP region Gaseous Volatile Organic Compound Emissions

(tpy) 2002 to 2018 - *Mobile down 785,779 tons (-50%), Point up 40,176 tons (+15%), Area up 499,144 tons (+38%), WRAP O&G Area up 310,648 tons (+71%)*



# Fires and Ozone

(urban contributor to urban impacts, direct formation from fire event(s), precursor transport?)



**Wildfire**



**Agricultural Fire**

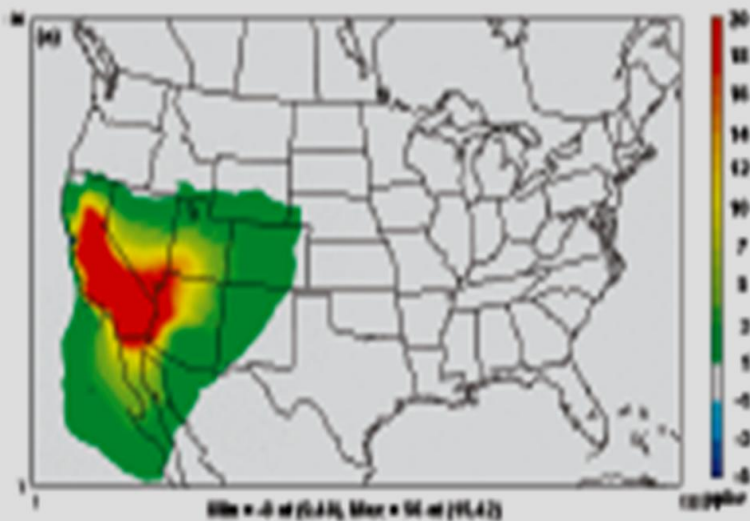


**Prescribed Fire**



**Residential Wood Burning**

# California Ozone Transport - Source Apportionment Study Results



Ozone Source Apportionment Monthly Mean Results (WRAP region states highlighted) Tong, D. Q. and Mauzerall, D. L. Summertime State-Level Source-Receptor Relationships between Nitrogen Oxides Emissions and Surface Ozone Concentrations over the Continental United States.

*Environmental Science & Technology, Volume 42, Number 21, 2008.*

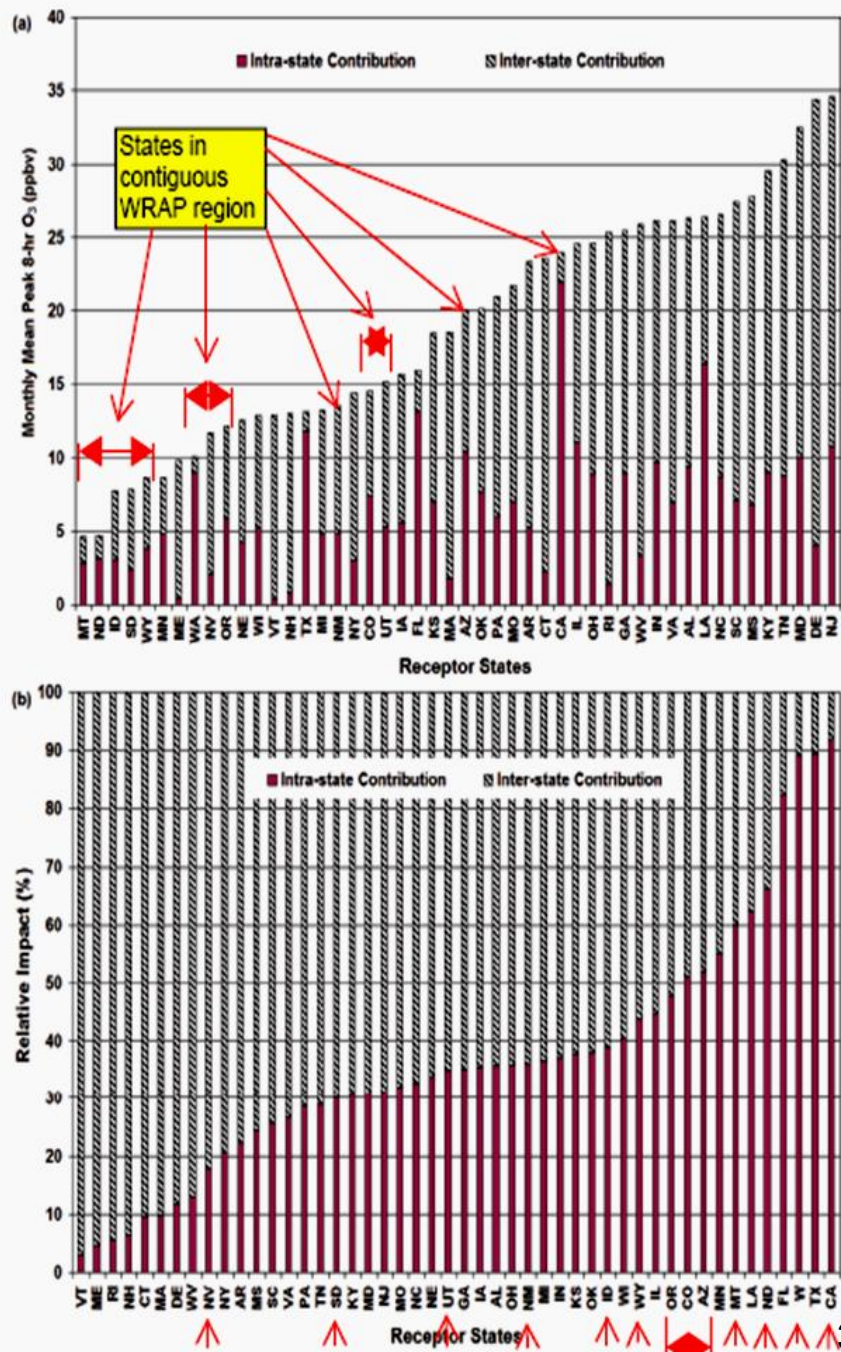
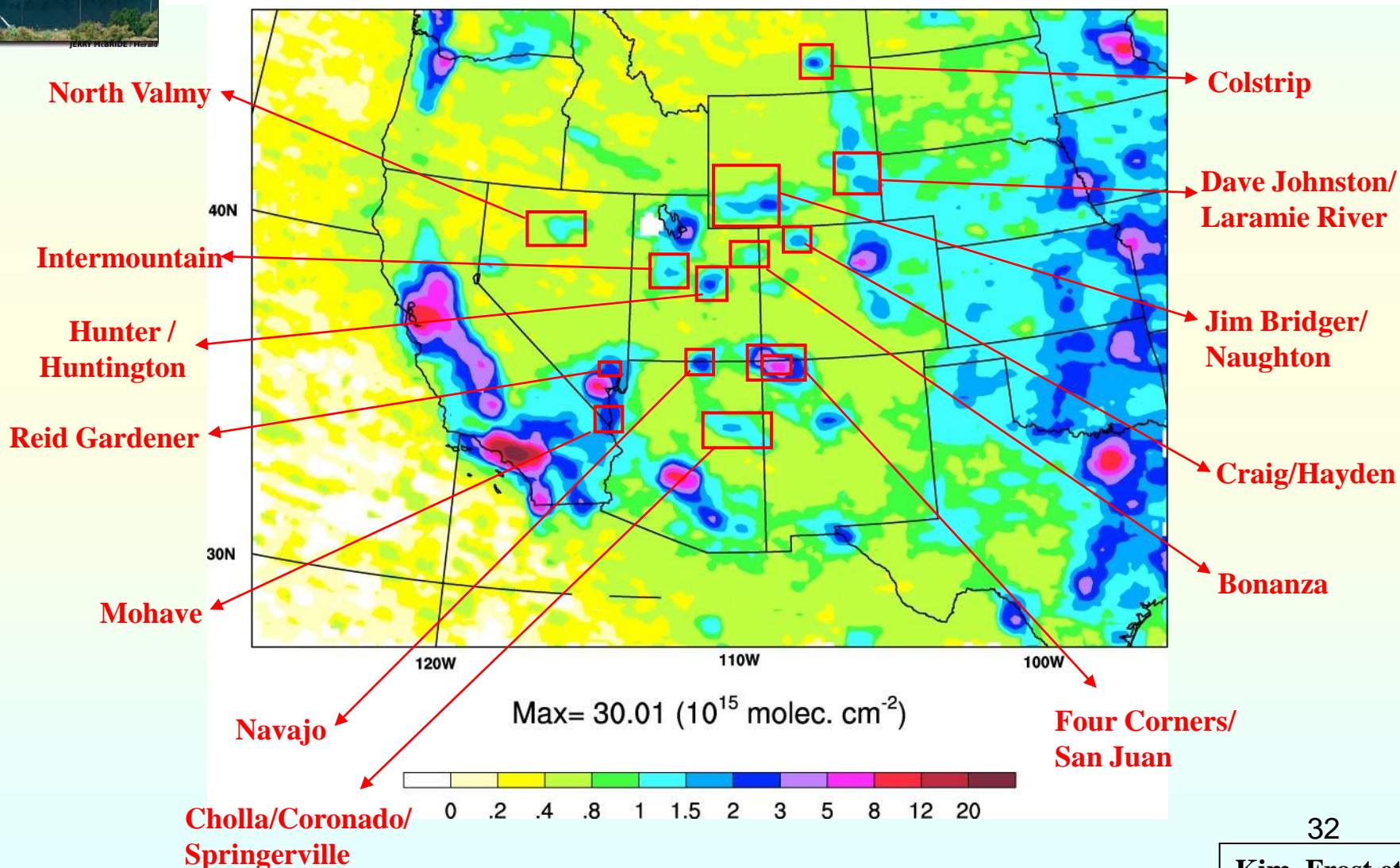
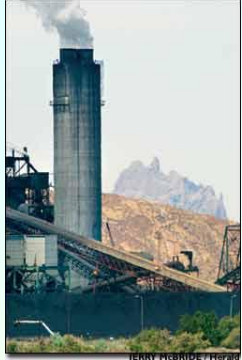


FIGURE 4. Contributions from intrastate and interstate NO<sub>x</sub> emissions to monthly mean peak 8 h surface O<sub>3</sub> concentrations in (a) ppbv; (b) percent.

# NO<sub>x</sub> Emissions from Western US Power Plants

- *Isolated plants have discrete signatures in satellite retrievals*
  - *Power plant emissions are measured continuously at each stack*
  - *Currently no post-combustion NO<sub>x</sub> controls on large coal-burning plants (some proposed)*
- *“Calibration” for satellite-model comparison*



SCIAMACHY satellite instrument, Summer 2005

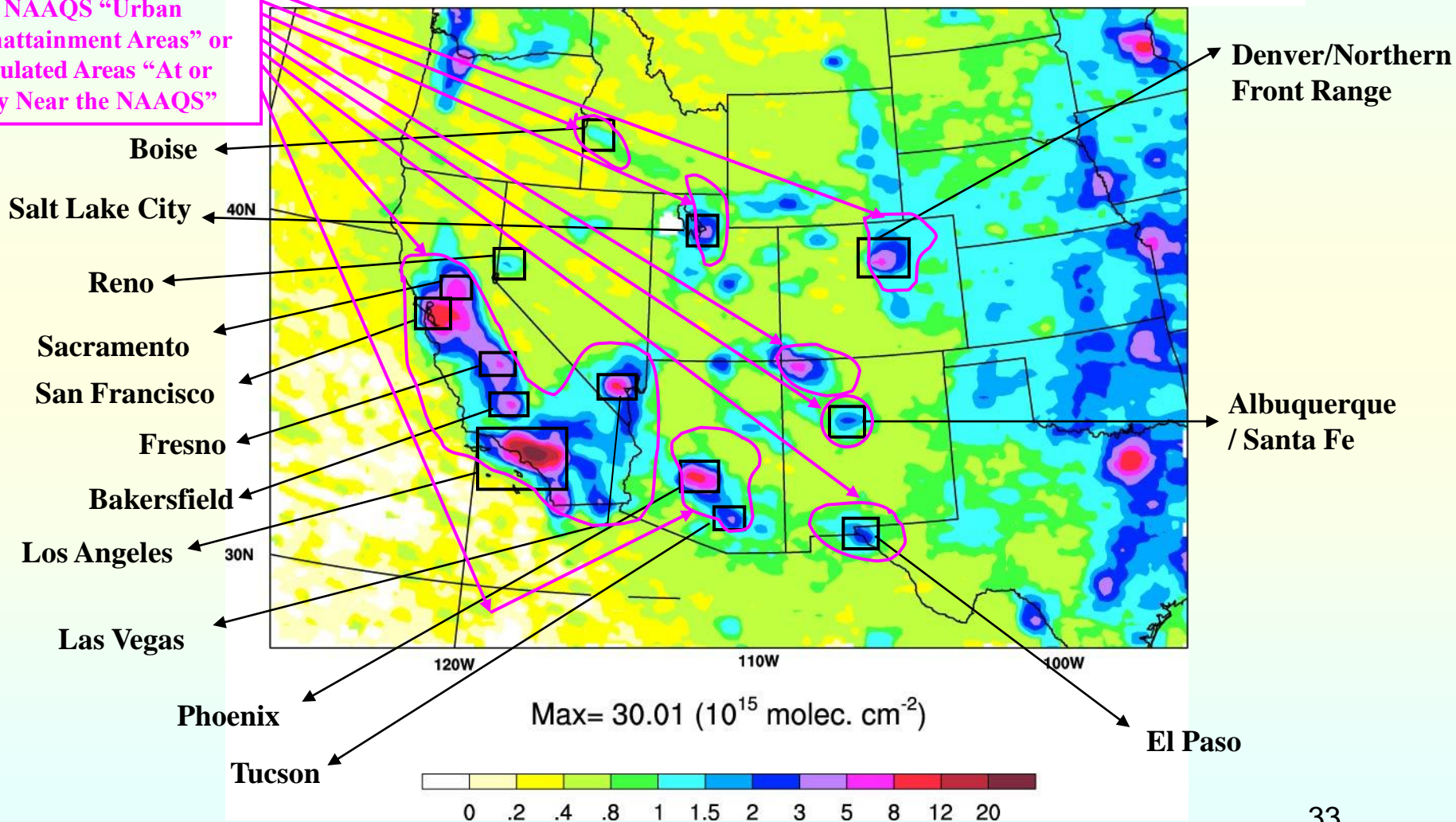


# NO<sub>x</sub> Emissions from Western US Urban Areas + O<sub>3</sub>/PM Urban and/or High Ambient Concentration Areas

*Build on satellite-model comparisons for power plants*

➤ *Evaluate urban area emission inventories and monitor changes*

Example Ozone and/or PM NAAQS "Urban Nonattainment Areas" or Populated Areas "At or Very Near the NAAQS"





# Research needs: Climate Change and Air Quality

- How does climate impact air quality?
- How does air pollution impact regional and global climate?
- What are the optimal strategies to adapt air quality management systems to changes in climate? For example:
  - Which air pollution control scenarios are worth pursuing in a changing climate regardless of the uncertainties associated with various future scenarios?
  - What additional air pollution mitigation efforts may be necessary as people alter behavior in response to future climate conditions?
  - What are the opportunities to devise and implement strategies that reduce air pollutants and climate pollutants simultaneously and cost-effectively (e.g., methane and black carbon)?

**Thanks –**

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**Extra slide with notes below –**

**Summary Report for the Workshop on Integrating Climate  
Change Adaptation into Air Quality Decision Making  
January 2008 – EPA ORD**

- **Multi-Pollutant Control Strategies and Co-Benefits**
- **Un-regulated sources**
- **Translation of Global Issues to Local Scales**
- **Planning now for future climate**