Western Sources and Trends:

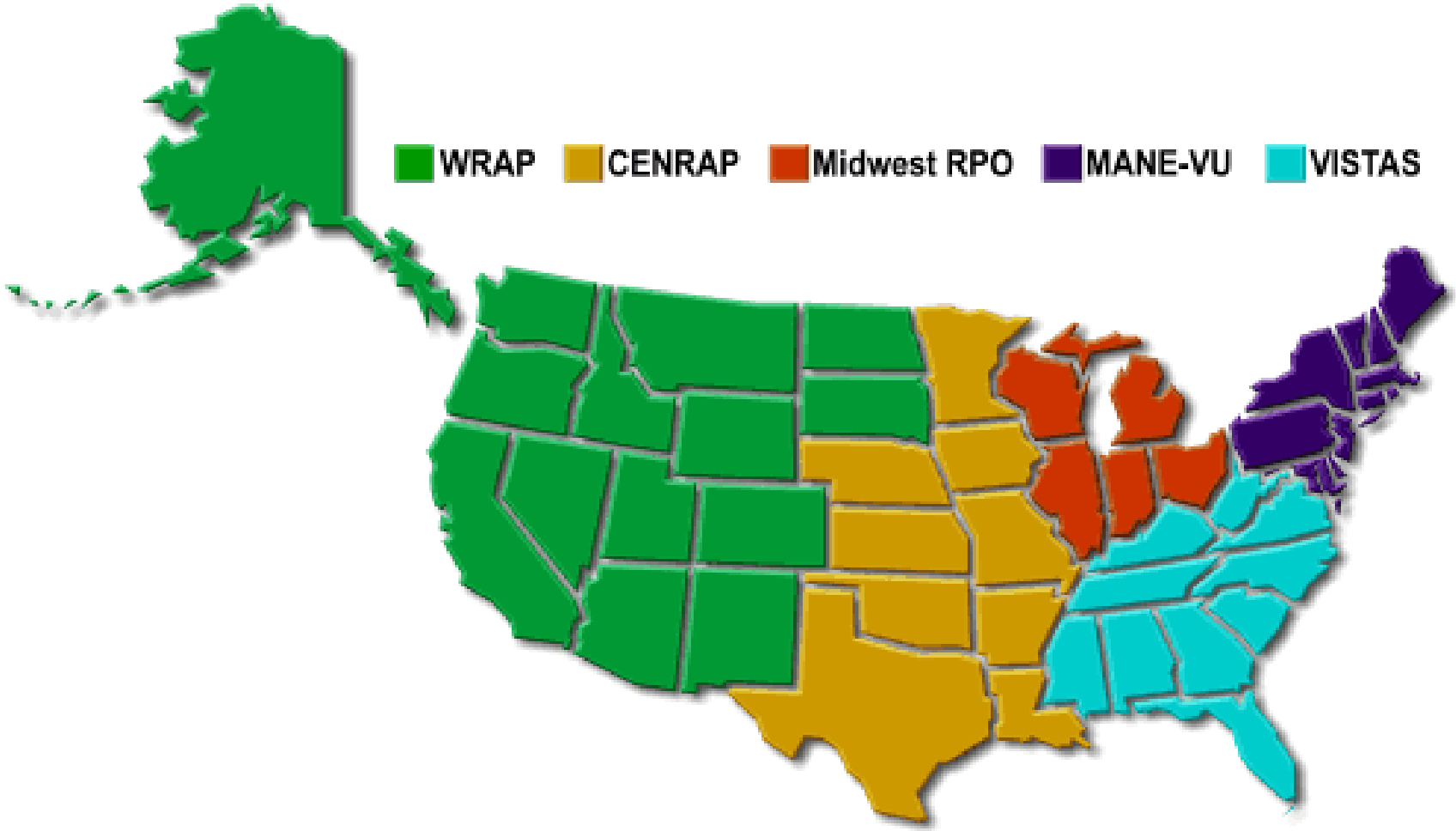
What do we know about emission sources across the West?

WRAP Ozone & NOx in the West meeting

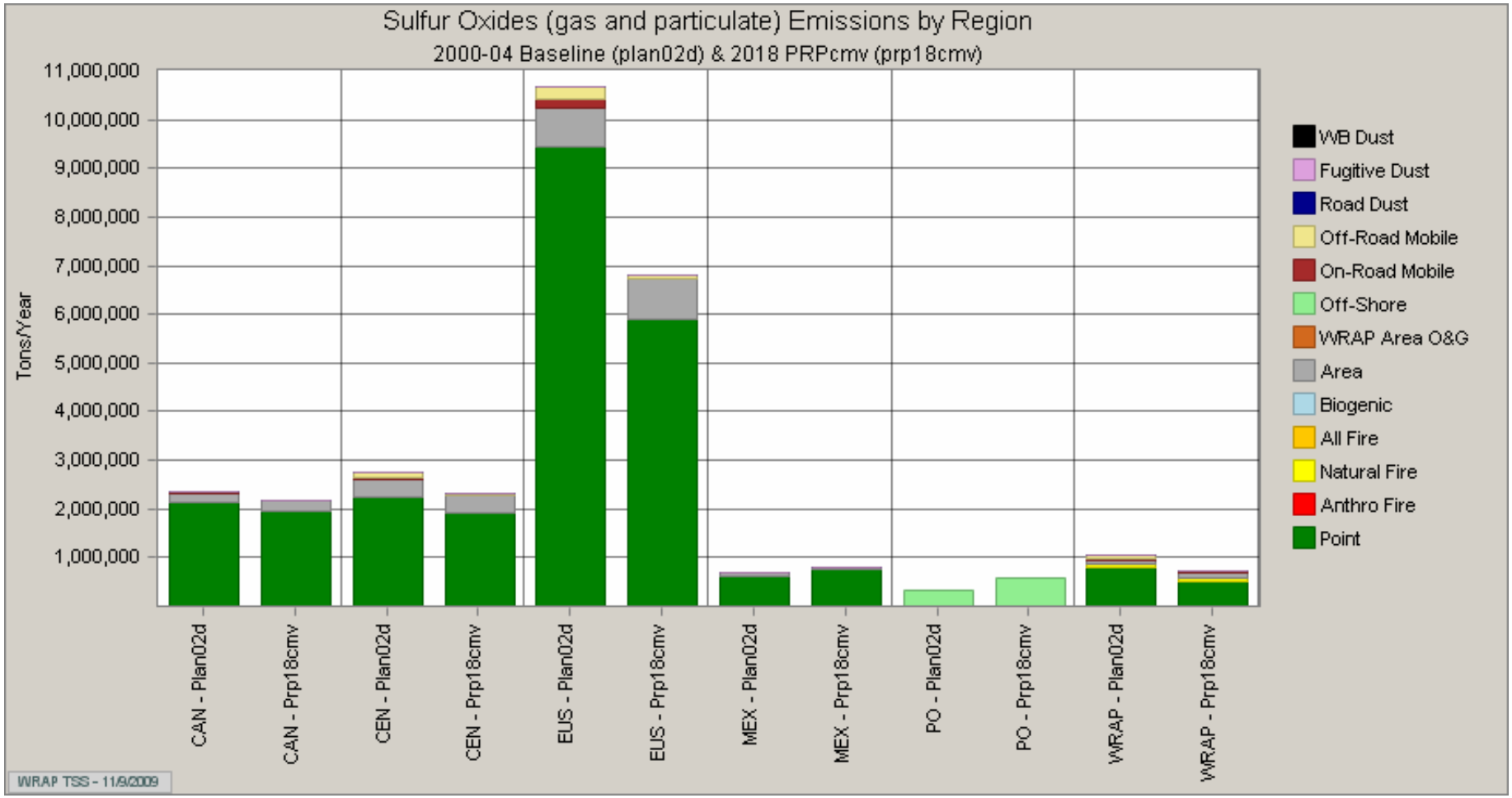
November 11, 2009

Santa Fe, NM

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

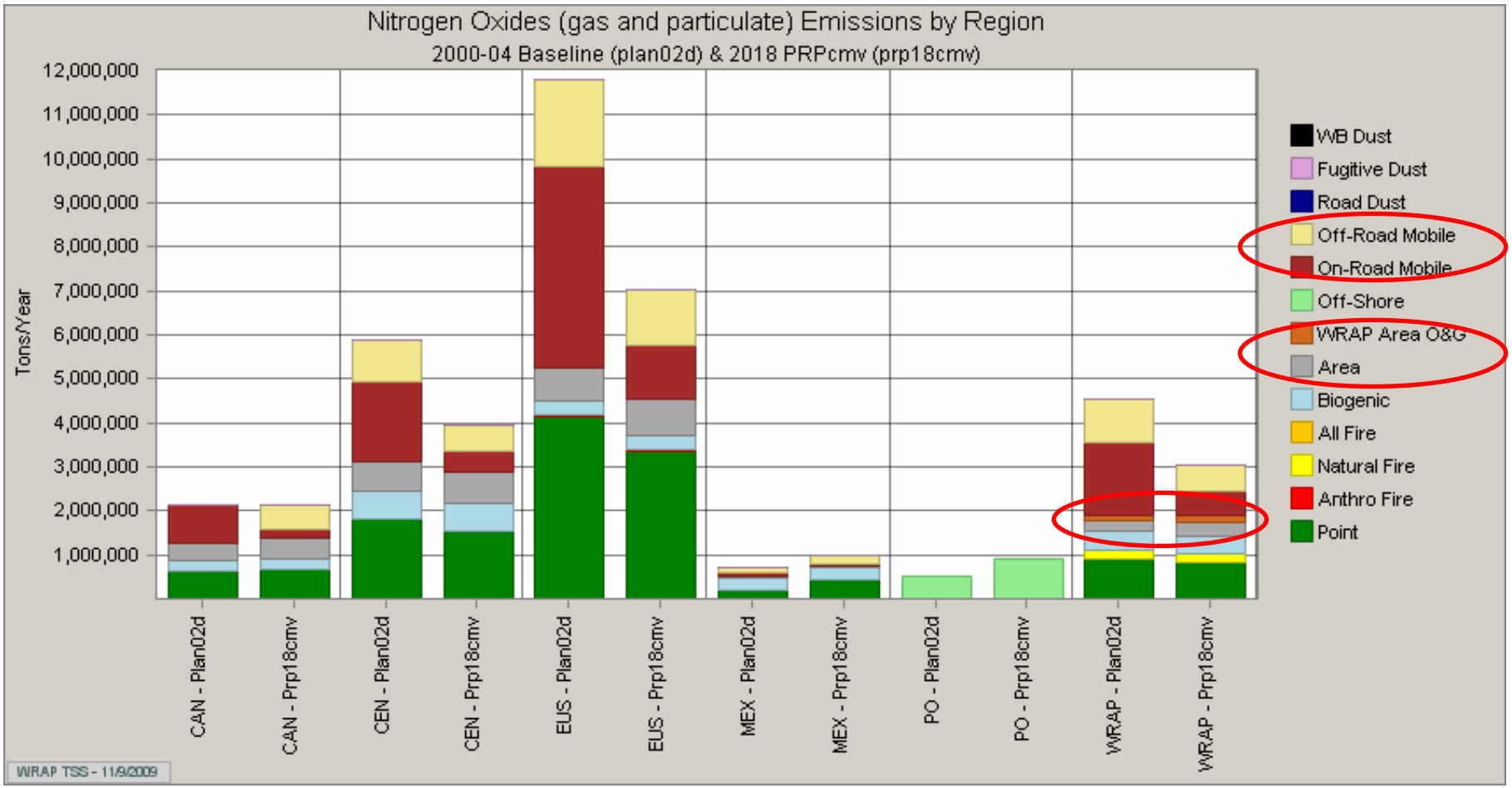


Change in SO2 Emissions (tpy) 2002 to 2018 across North America



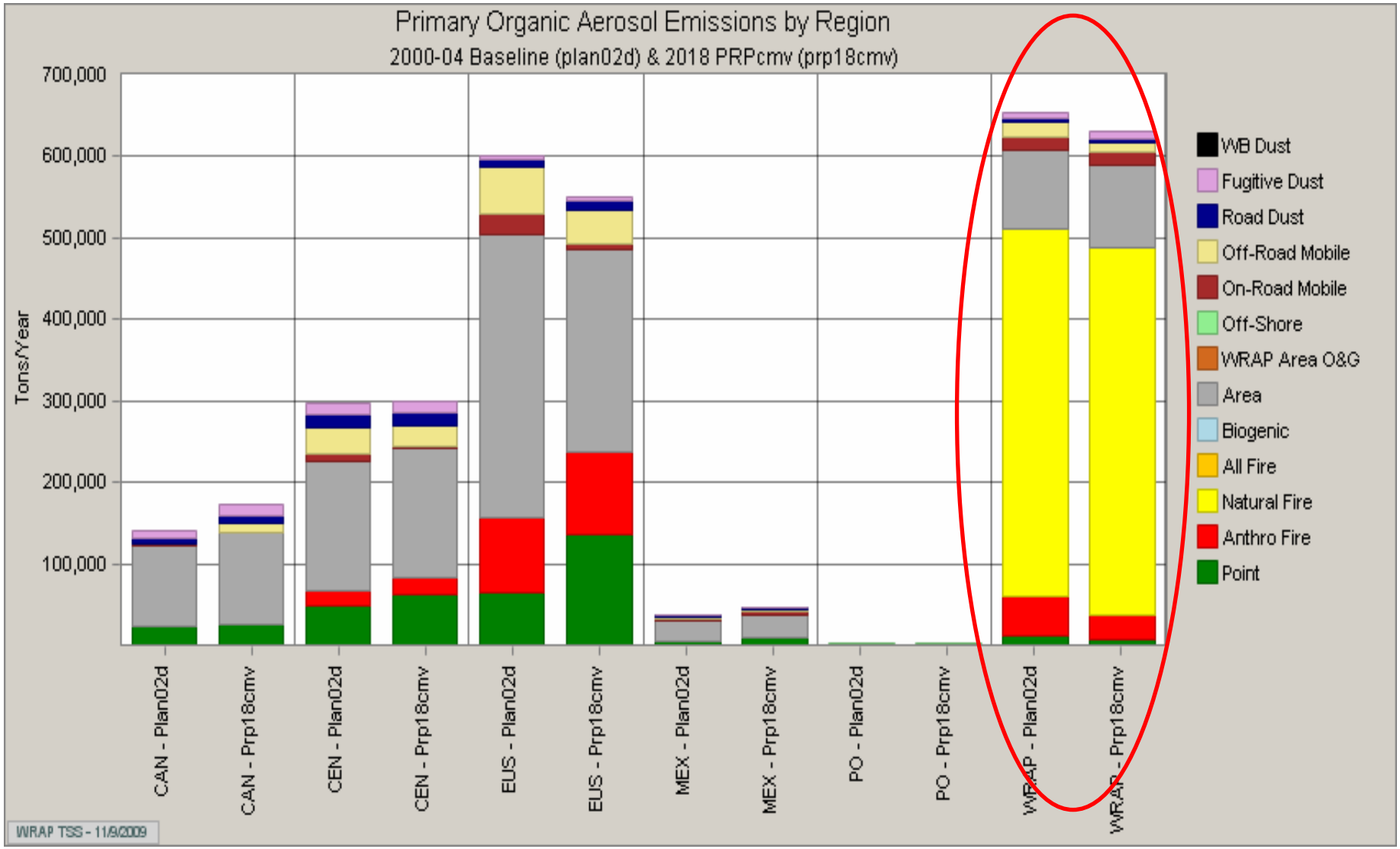
All SO_2 Sources 2002 to 2018	Canada	CENRAP	Eastern US	Mexico	Pacific Off-Shore	WRAP
Tons/year	-159,003	-445,526	-3,856,861	+99,105	+273,413	-341,348
%	-7%	-16%	-36%	+14%	+88%	-32%

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



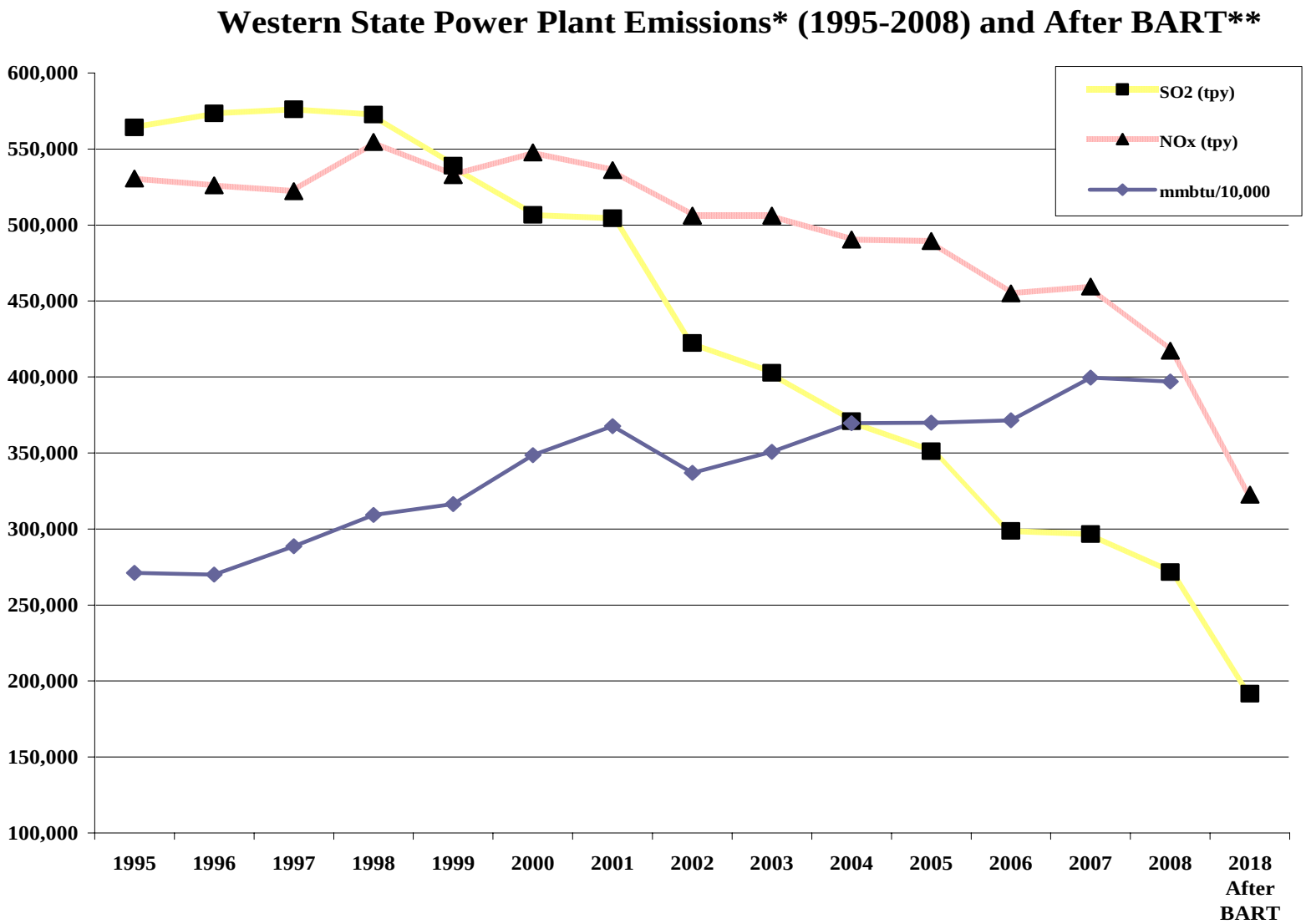
All NO_x Sources 2002 to 2018	Canada	CENRAP	Eastern US	Mexico	Pacific Off-Shore	WRAP
Tons/year	-17,043	-1,947,438	-4,765,494	+280,697	+391,972	-1,518,746
%	-1%	-33%	-40%	+39%	+76%	-33%

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

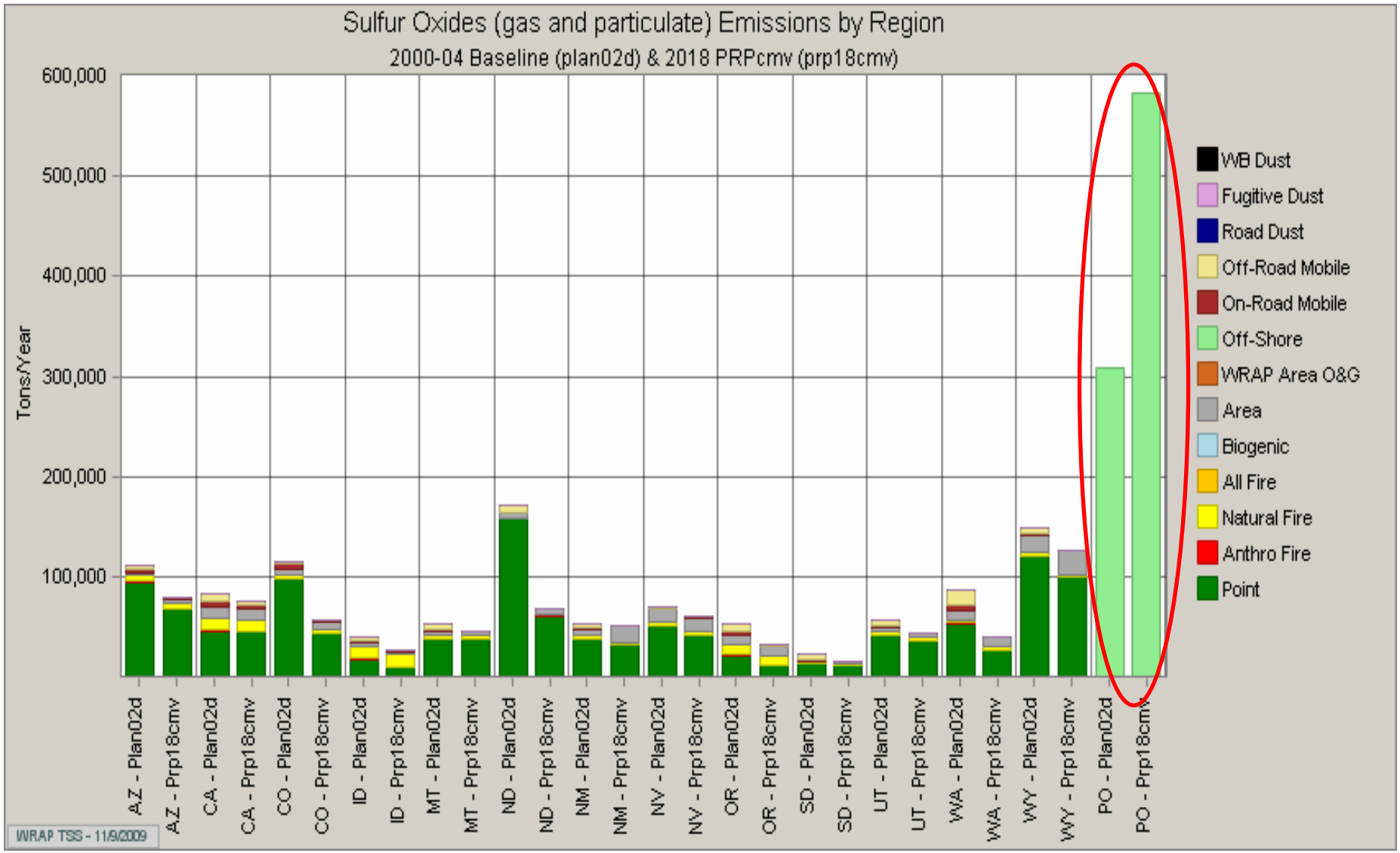


* Currently operating coal, gas, and fuel oil-fired plants in the 11-state Western Interconnection

** Estimates for BART controls are from WRAP PRP18b emissions analysis at: [http://www.wrapair.org/forums/ssjf/pivot.html]

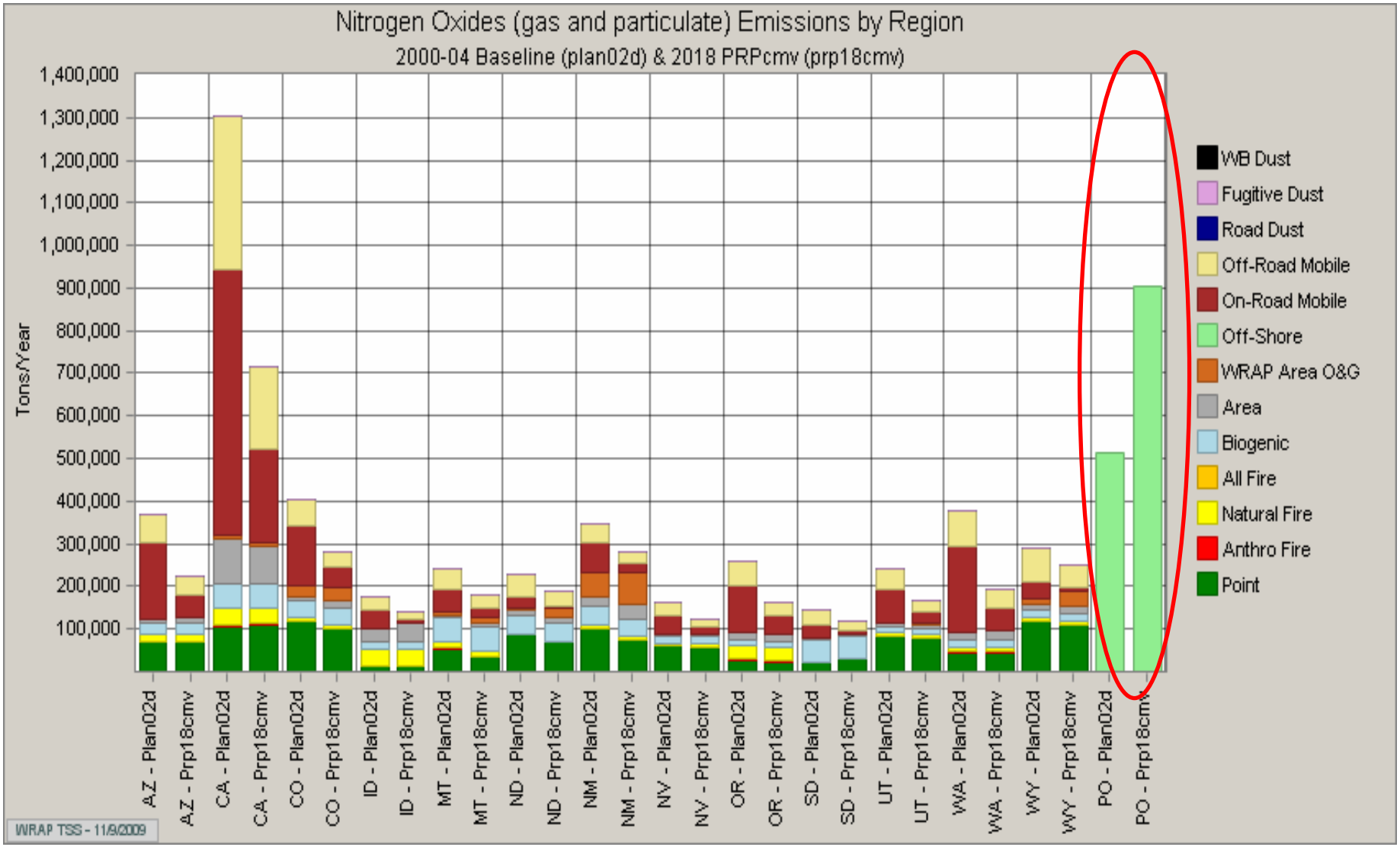
Change in WRAP region SO2 Emissions (tpy) 2002 to 2018

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



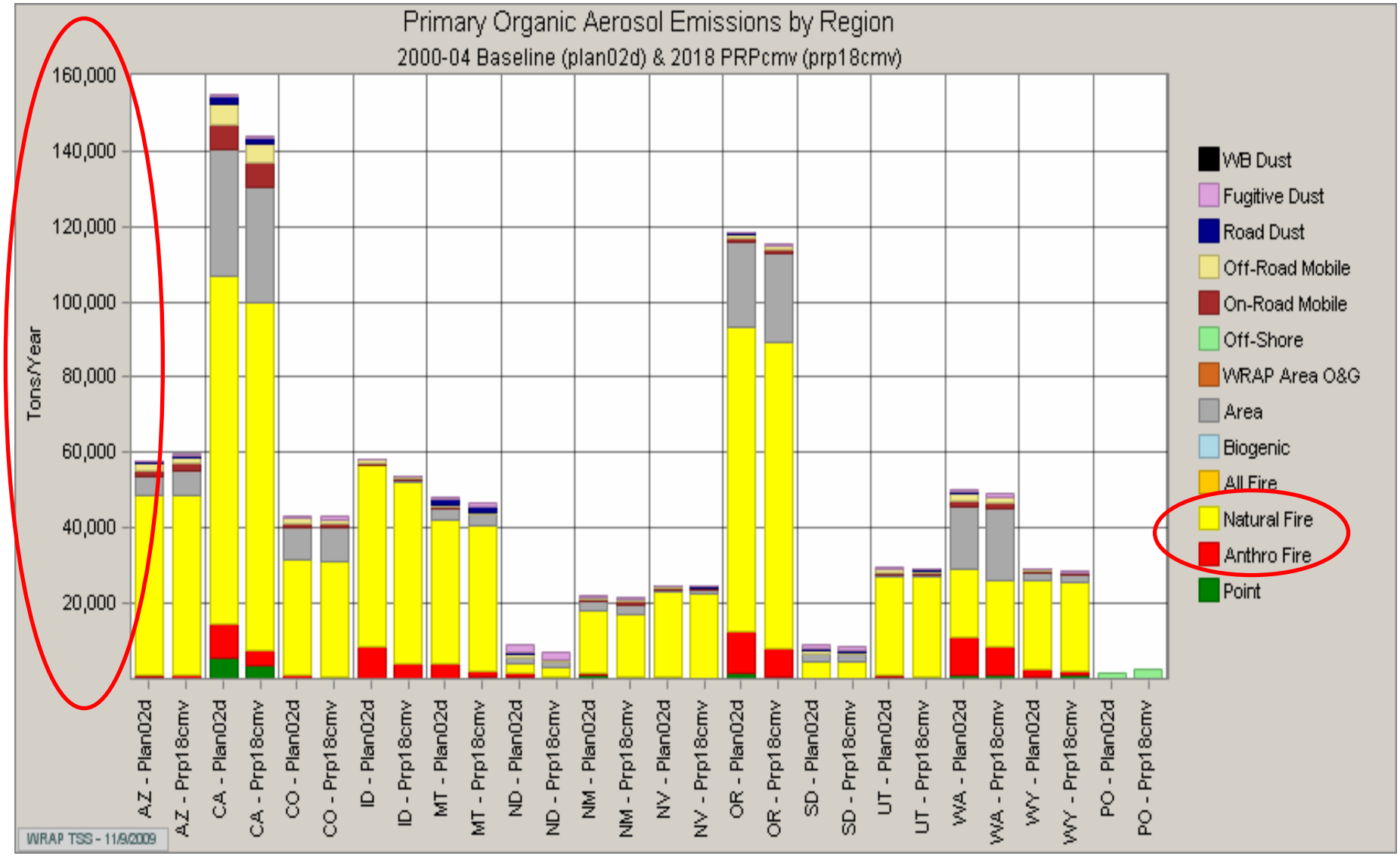
Change in WRAP region NOx Emissions (tpy) 2002 to 2018

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



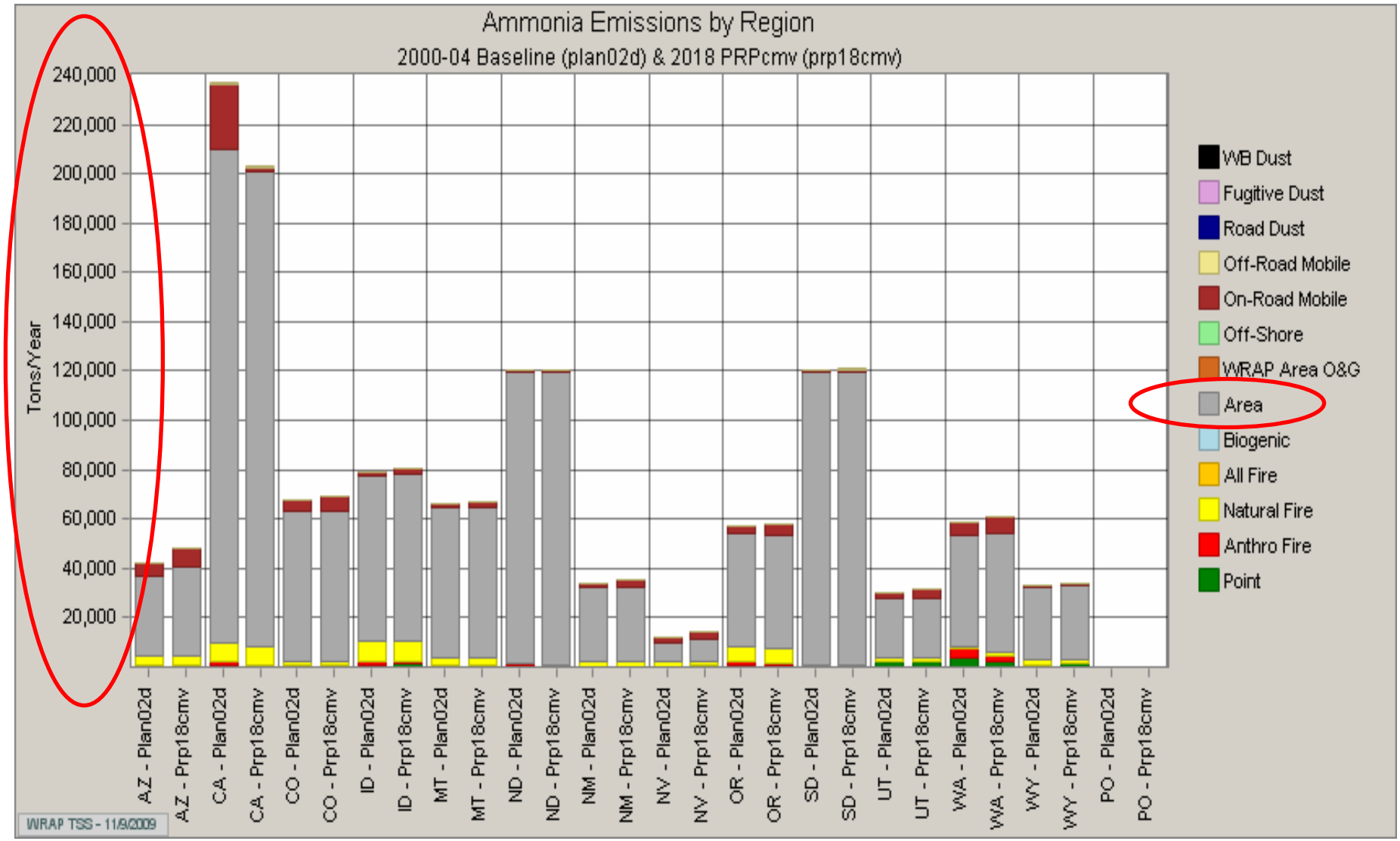
Change in WRAP region Primary Organic PM2.5 Emissions (tpy) 2002 to 2018

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

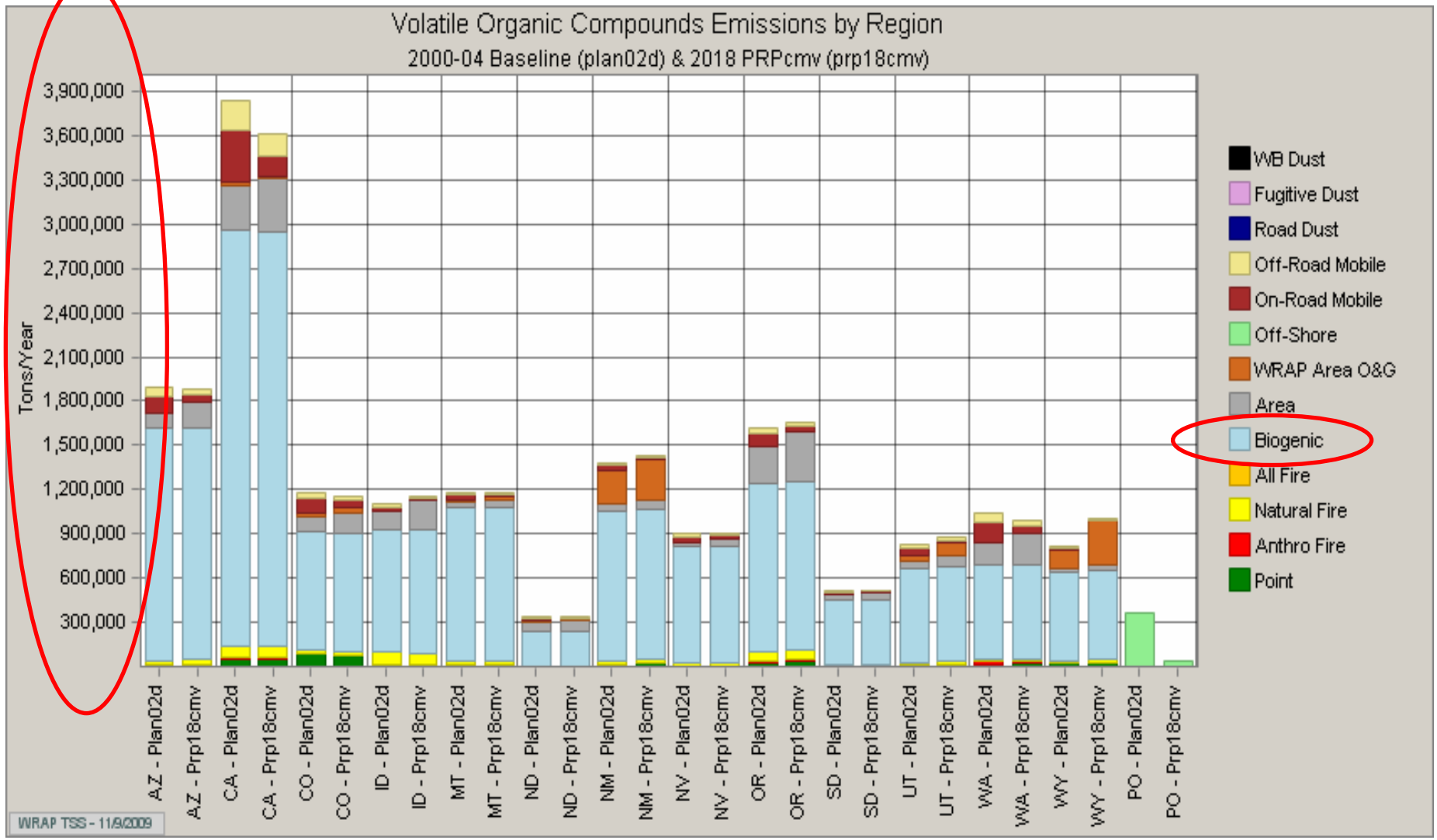


Change in WRAP region Ammonia Emissions (tpy) 2002 to 2018

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%)*



Questions & more work needed on methane, speciation, spatial/temporal/source type allocation

Western Oil & Gas Emissions

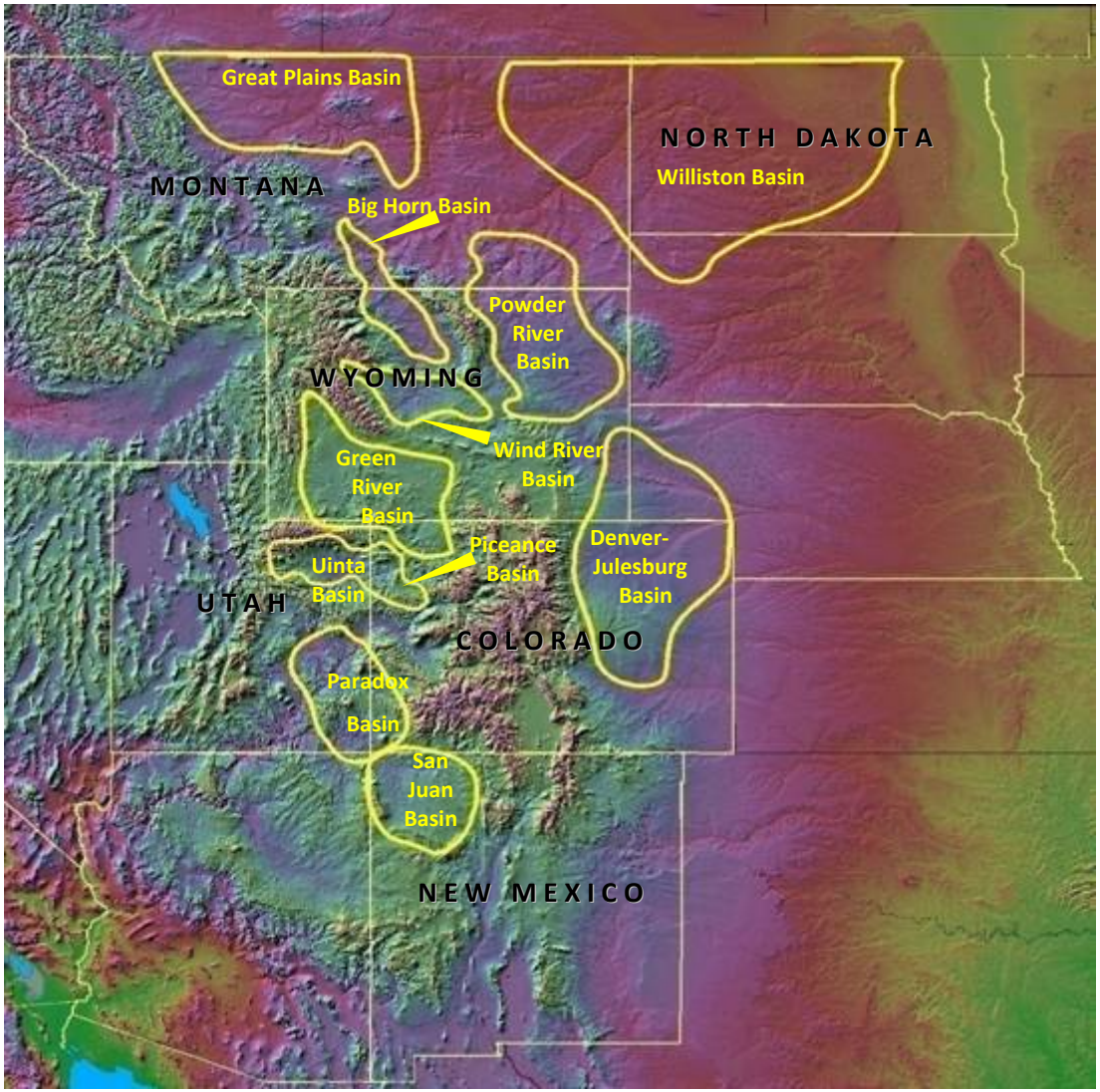
WRAP Oil & Gas Emissions Workgroup

- Originally formed from SSJF to look at O&G issues
- Guided development of the Phase 1 Regional O&G Emission Inventory in 2005
  - Phase I project found 116K Tons of NOx from O&G **Area Sources** not previously counted (900% increase from previous 2002 baseline)
- Phase II O&G Inventory Update by WG in 2007
  - improved accuracy, updated to 2005 baseline for a revised 2018 projection methodology, evaluated potential controls
- Currently overseeing the IPAMS Phase III O&G Emission Inventory development project

Why a Phase III?

- Earlier inventories focused primarily on NOx and SOx – Phase III includes **all criteria pollutants including VOCs** (critical for regional issues - haze, ozone, rural PM, etc.)
- Phase III provides opportunity for **greater industry participation by combining analyses of detailed local equipment & activity survey data from unpermitted sources, with state & EPA permitting data,** to improve baseline emissions inventories for all basins for **all source categories**
- Phase III updates **baseline year to 2006** to reflect continued increase in O&G production, and makes use of best available O&G production statistics (IHS database)
- Phase III provides opportunity to improve on estimates and assumptions from Phases I & II based on comments received on those inventories – can account for well declines, technology advances, and new regulations

Basins in Phase III Study



- Denver-Julesburg
- Piceance
- Uinta
- San Juan (North & South)
- Powder River
- Wind River
- Green River
- Williston-Great Plains
- Big Horn*
- Paradox*

* Phase III work for these basins has been cancelled, mainly due to funding, also not much new activity

Phase III Emissions Inventory Sources

- Natural Gas Processing Plants
- Compressor Stations
- Wellhead Compressor Engines
- CBM Pump Engines
- Miscellaneous or Exempt Engines
- Drilling/Workover Rigs
- Salt-water Disposal Engines
- Artificial Lift Engines (Pumpjacks)
- Vapor Recovery Units (VRUs)
- Oil/Gas Well Heaters
- Hydrocarbon Liquid Storage Tanks
  (Breathing Losses, Venting & Flash Emissions)
- Well Completions
- Fugitive Emissions
- Completion Venting
- Well Blowdowns
- Dehydration Units
- Amine Units
- Hydrocarbon Liquid Loading
- Landfarms
- Water Treatment/Injection
- Flaring
- Pneumatic Devices
- Produced Water Tanks
- Truck Hydrocarbon Loading

Phase III Study Review Process

- WRAP O&G Workgroup will have calls for each basin, study base and future years' emission inventory results and review the final technical memos
- Workgroup participants represent: States & Tribal Agencies, EPA, Federal Land Managers, O&G Industry, Environmental Interest Groups (usually 40+ participants)
- WRAP staff will summarize comments from each basin workgroup session

- Phase III work products at:

  http://www.wrapair.org/forums/ogwg/PhaseIII_Inventory.html

(Each Basin includes Technical Memo & Emission Summary Spreadsheets)

Phase III Results To Date

(2006 Baseline Emissions)

Basin	Well Count			Oil Production (bbl)			Gas Production (MCF)			Spud Counts
	total	CONV	CBM	Total	Oil Well Oil	Gas Well Condensate	Total	CONV	CBM	Total
Denver-Julesberg	19,841	**19,841**	0	**14,242,088**	0	**14,242,088**	234,630,779	234,630,779	0	**1500**
Uinta	6,881	6,018	863	11,528,121	**9,758,247**	1,769,874	331,844,336	254,219,432	77,624,904	1069
Piceance	6,315	6,255	60	7,158,305	5,755,076	1,403,229	421,358,666	420,165,237	1,193,429	1186
North San Juan	2,676	1,009	1,667	32,529	27,962	4,567	443,828,500	28,642,418	415,186,082	127
South San Juan	**20,649**	16,486	**4,163**	2,636,811	1,002,060	1,634,751	**1,020,014,851**	**520,060,869**	**499,953,982**	919

Basin	Emissions (tons/year)				
	NOx	VOC	CO	SOx	PM
Denver-Julesberg	20,783	**81,758**	12,941	226	636
Uinta	13,093	71,546	8,727	**396**	623
Piceance	12,390	27,464	7,921	314	**992**
North San Juan	835	69	321	1	10
South San Juan	**42,075**	60,697	**23,471**	305	574

Phase III Study Schedule
(Baseline & Mid-Term: 5 Basins Completed)

April 2008	• Completed D-J Basin baseline 2006 emissions and mid-term 2012 projections
January 2009	• Completed Piceance Basin baseline 2006 emissions and mid-term 2012 projections
March 2009	• Completed Uinta Basin baseline 2006 and mid-term 2012 projections
September 2009	• Completed North San Juan Basin baseline 2006 emissions and mid-term 2012 projections
October 2008	• Completed South San Juan Basin baseline 2006 & mid-term 2012 projections

Phase III Study Schedule
(5 Basins To Go)

December 2009	• Anticipated completion Wyoming Powder River & Wind River Basins baseline 2006 emissions & mid-term 2012 projections
January 2010	• Anticipated completion Williston & Great Plains Basins baseline 2006 and mid-term 2012 projections
January 2010	• Anticipated completion Wyoming Green River Basin baseline 2006 and mid-term 2012 projections
January 2010	• Begin Far Future Year 2018 Projections for all Basins
March 2010	• Anticipated completion Far Future Year 2018 Projections for all Basins
March 2010	• Anticipated Final Project Report

Thanks -

WRAP Oil & Gas Emissions Workgroup – Recent Activities

- Also looking at other O&G issues beyond Emission Inventories
  - Looking at overseeing a "Pilot Project" to evaluate emissions from mobile sources associated with O&G operations
  - Reviewed BLM "Best Management Practices" presentation for use in training staff on O&G issues during leasing/permitting activities
  - Reviewing EPA VOC Field Monitoring Studies of O&G water pond operations in the Rocky Mountain region
  - Reviewing Texas Commission on Environmental Quality (TCEQ) study of "Flash Gas Emissions" from O&G Storage Tanks

- Open to All Interested O&G Stakeholders – Bimonthly Calls – Contact Lee Gribovicz to join mailing list (lg@westgov.org)

- Website: http://www.wrapair.org/forums/ogwg/index.html