Dimensions, Uncertainties, and Impacts of Emissions in the Western U.S.

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EPA 2015 International Emission Inventory Conference
"Air Quality Challenges: Tackling the Changing Face of Emissions"
Topics

- Overview of the WESTAR/WRAP organization
- Key issues and areas of focus
- Selected results from projects and studies related to this Conference
Overview of WESTAR and WRAP

- **Purpose**
  - Service organizations
  - Assist members in achieving their air quality management goals

- **WESTAR**
  - Training
  - Provide a forum for discussion
  - Inform policy-related discussions
  - [www.westar.org](http://www.westar.org)

- **WRAP** - provides technical support (esp. regional)
  - Virtual organization, not incorporated
  - 65+ member agencies include 15 state air agencies, NPS, FWS, BLM, USFS, EPA, and interested tribes and local air agencies/districts in the WRAP region
  - Board has representatives across states, tribes, federal, and local agencies
  - [www.wrapair2.org](http://www.wrapair2.org)
WRAP current projects and priorities

- precursors to Ozone, Particulates, and Regional Haze - key western sources
  - Power plants
  - Mobile sources
  - Fire activity and effects
  - Biogenics (natural) emissions
  - Oil and gas exploration and production
- All sources studied in comprehensive regional modeling analyses
  - West-wide Jumpstart Air Quality Modeling Study (WestJumpAQMS)
  - Western Air Quality Data Warehouse (WAQDW)
Western Electrical Interconnect

WECC
Existing Transmission System

- 230 kV HVAC
- 345 kV HVAC
- 500 kV HVAC
- ± 500 kV HVDC
Western Interconnect Fossil Fuel Power Plant Emissions

1996 through 2014 data from EPA data for fossil fuel-fired electrical generating units in the 11-state Western Interconnect

* Additional NOx reductions estimate - BART controls from Regional Haze baseline planning

** Further NOx reductions from applying maximum post-combustion controls to all remaining units
Smoke/Fire & the Ozone and PM NAAQS, Regional Haze Rule

Technical Products for air quality planning & management as required by the Clean Air Act

Future emissions, efforts to avert emissions & health/visibility impacts, & adapt to a changing/varying climate

U.S. Wildfire and Prescribed Fires Acres Burned - 1990 through 2014

Data from National Interagency Fire Center, no prescribed fire data before 1998

Wildfire Acres
Prescribed Fire Acres
2007
6/21 – 9/21
Limited by bounding box

Source: WRAP Fire Tools
2008

6/21 – 9/21

Limited by bounding box

Source: WRAP Fire Tools
2011

6/21 – 9/21
Limited by bounding box

*Obtained additional small wildfire data for this inventory

Source: WRAP Fire Tools
Example Oil & Gas Study: Williston Basin 2011 Baseline Results
NOx Emissions By Source Category

Basin-wide NOx Emissions (tons/year): 29,404

Source: BLM/WRAP Oil and Gas Inventory project
Geographic Extent

- **Oil Wells**
- **Gas Wells**
- **CBM Wells**
- **Tribal Airshed**
- **State Jurisdiction**
- **IPAMS Basins**
  - D-J
  - North San Juan
  - Piceance
  - Powder River
  - South San Juan
  - Southwest Wyoming
  - Uintah
  - Williston
  - Wind River

- **Tribal Lands**
Per well NOx emissions relatively consistent across basins – differences mainly due to usage of compression and centralized vs. wellhead compression
Cross-Basin – Per-Unit-Gas-Production VOC Emissions

Per unit gas production VOC emissions vary widely across basins – differences due to levels of liquid hydrocarbon production (oil and condensate) and VOC content of produced gas.
Cross-Basin – Per-Unit-Liquid-Production VOC Emissions

Per unit gas production VOC emissions vary widely across basins – differences due to levels of liquid hydrocarbon production (oil and condensate) and VOC content of produced gas.
• No standardized methodology for conducting projections
  • Each inventory study has used different approaches (EPA methods, Resource Management Plans, NEPA air quality projects, Western States Air Quality Modeling Study regional inventories)

• WRAP O&G inventories have used a three-step approach:
  1. Activity scaling factors
  2. “Uncontrolled” projections
  3. State and federal regulatory control requirements

• Activity scaling requires input from operators on planned activities, and/or analyzes trends, and/or relies on industry studies

• State and federal regulatory control requirements complex and continuing to evolve
  • National rules focused on new sources
### Trends in projected emissions - example

#### State Total Inventory Change: 2020-2011

- Mostly decreases for all sectors/pollutants/states except O&G VOCs
- Plots show differences for example states (CO, UT, WY)

#### Source: Western Air Quality Data Warehouse

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Tons/Year Change (2020-2011)
What are (some of) the sources and control issues in the West related to a new Ozone standard?

- Urban and rural reactivity
- Transport and formation – how much / how important?
- Public lands with large biogenic emissions and fire activity
  - How to characterize for effects of drought and climate variation?
- Federal and state mobile fuel and tailpipe controls
- Upstream Gas NSPS rules in place in 2015
  - Industry practices changing rapidly, e.g., green completions
- Point sources (dominated by EGUs for SO$_2$, NO$_x$)
  - Significant NO$_x$ BART by ~2018
  - Less coal-fired electricity supply due to Clean Power Plan?
  - 17+ million acres of public lands leased in last 5 years for O&G exploration and production
Numerous sources within and outside the U.S. will continue to contribute to air quality impacts across the West

Some are further controllable

Others are less controllable, quasi-natural, and/or less well-understood - these may grow and/or vary significantly within the CAA planning timeframes
Counties with Monitors Violating Primary 8-Hour Ground-Level Ozone Standard (0.075 ppb)

(Based on 2011-2013 Air Quality Data)

http://www.epa.gov/airquality/greenbook/map8hr_2008.html
3-year Average 4th Highest 8-Hour Ozone value by County 2011-2013

AQS Federal Reference Method data from the monitoring site in each County with the highest Ozone values
3-year Average 4th Highest 8-Hour Ozone value for Rural/Class I Sites 2011-2013

AQS Federal Reference Method data from rural or Class I area monitoring sites
Contributions to Ozone at Rocky Mountain National Park

Rank (10) 05/01/08; Model = 68.8 ppb; Obs = 69.9 ppb; Bias = -1.6%; BC = 60.4 ppb (87.9%)

Source: WestJumpAQMS
“Other Sources” Max Contrib. 4th High DMAX8 Ozone

Boundary Conditions  | Natural  | Anthropogenic
---|---|---
Wildfire  | Prescribed Fire  | Agricultural Fire

Contrib. to CAMx Daily Max 8-Hour Ozone >= 0 ppb
Wildfires 4th Highest Contribution
Contrib. to CAMx Daily Max 8-Hour Ozone >= 0 ppb
Prescribed Fire 4th Highest Contribution
Contrib. to CAMx Daily Max 8-Hour Ozone >= 0 ppb
Agricultural Burns 4th Highest Contribution

Max(22,2) = 80.37  | Max(70,11) = 12.64  | Max(133,70) = 110.89
Max(129,53) = 60.13  | Max(116,41) = 6.16  | Max(78,51) = 3.15
Uncertainty in model estimates of U.S. Background

CAMx simulations for 2007 and 2008 at Canyonlands National Park – Eastern UT

EPA 2007 CAMx model:
BC contributions of 36-57 ppb; still substantial U.S. anthropogenic contribution to O3.

WRAP 2008 CAMx model:
BC contributions of 50-72 ppb, much larger than OAQPS modeling.

Same methodology - reasons for modeled differences are not fully understood
Meetings and Workshops

San Joaquin Valley Unified Air Pollution Control District – *Transboundary Ozone Pollution Conference* – March 31-April 2, Tenaya Lodge, Yosemite National Park

EPA *Emission Inventory Conference* – April 13-16, San Diego

WRAP-EPA *Modeling Air Quality from the Global to Local Scale* Workshop – May 11-15, Boulder, CO

Thanks –

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