

# West-wide Jumpstart Air Quality Modeling Study

## Final Project Report and Modeling Results



December 18, 2013

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Funding from State of NM and National BLM Air Program

Oversight by western states, local air agencies, federal land managers, EPA regional and national offices

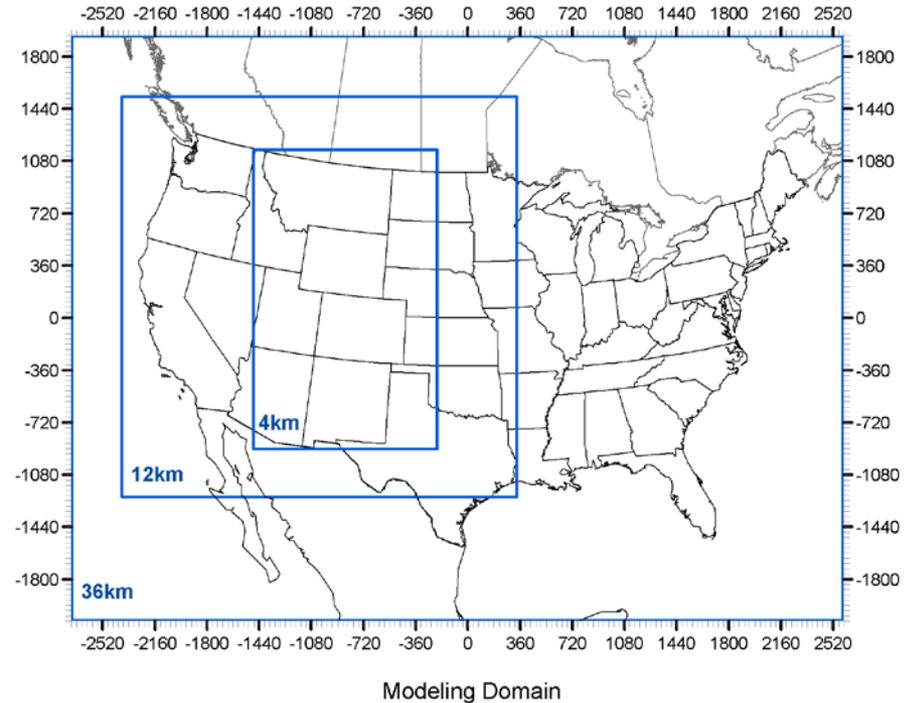


# Introduction

- West-wide Jump-start Air Quality Modeling Study (WestJumpAQMS) was initiated in late 2010 to:
  - Develop the next generation of regional air quality modeling databases for ozone, PM<sub>2.5</sub>, visibility and deposition planning in the western U.S.
  - Provide information on the role of interstate and international transport to ozone and PM<sub>2.5</sub> under current and potential future NAAQS
  - Assess contributions of major source categories (e.g., point, O&G, mobile, et cetera) to air quality in the West
  - Provide detailed information to the community

# Overview of Approach

- 2008 Modeling Database
  - 36 km CONUS
  - 12 km WESTUS
  - 4 km IMWD
- WRF meteorological; CAMx photochemical; SMOKE emissions models
- 2008 WRAP Phase III O&G emissions
- 2008 NEI emissions
- Model Evaluation
- Sensitivity Tests



- State-Specific and Source Category-Specific Ozone and PM<sub>2.5</sub> Source Apportionment Modeling

# WestJumpAQMS Products

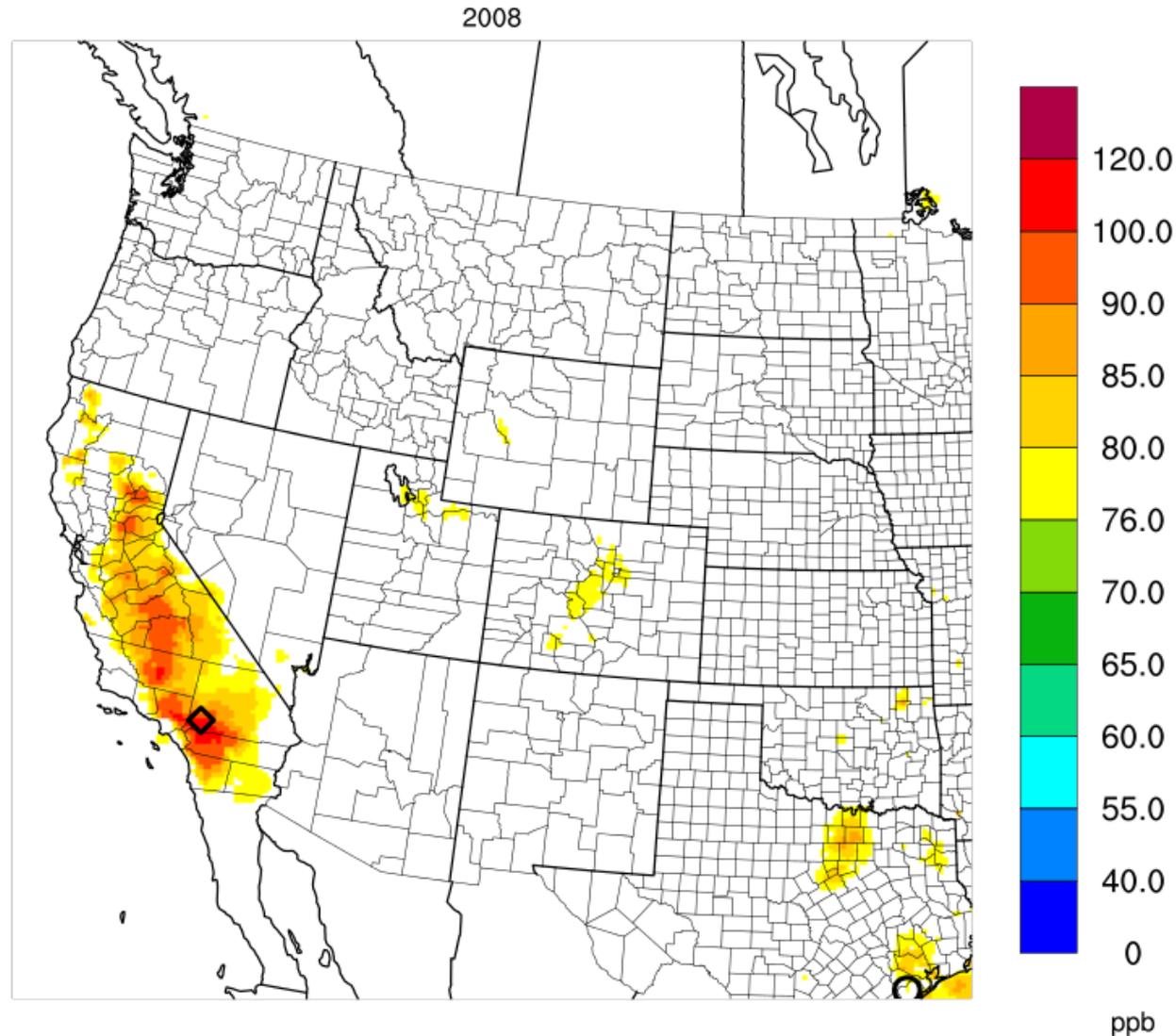
- Final Report
  - 15 Electronic Appendices
  - Response-to-Comments
- Ammonia Emissions Recommendations Memo
- Modeling Protocol
  - Response-to-Comments
- WRF Application/Evaluation Report
  - Evaluation down to individual monitoring site
  - Response-to-Comments
- 16 Technical Memorandums on Emissions
  1. Point Sources
  2. Area + Non-Road
  3. On-Road Mobile
  - 4a-e. Oil and Gas (5 geographic areas)
  5. Fire (WF, Rx & Ag)
  6. Fugitive Dust
  7. Off-Shore Shipping
  8. Ammonia
  9. Biogenic
  - 11 Mexico/Canada
  12. Sea Salt and Lightning
  13. Emissions Modeling Parameters

**All information on WestJumpAQMS website**

# WestJumpAQMS Progress Webinars

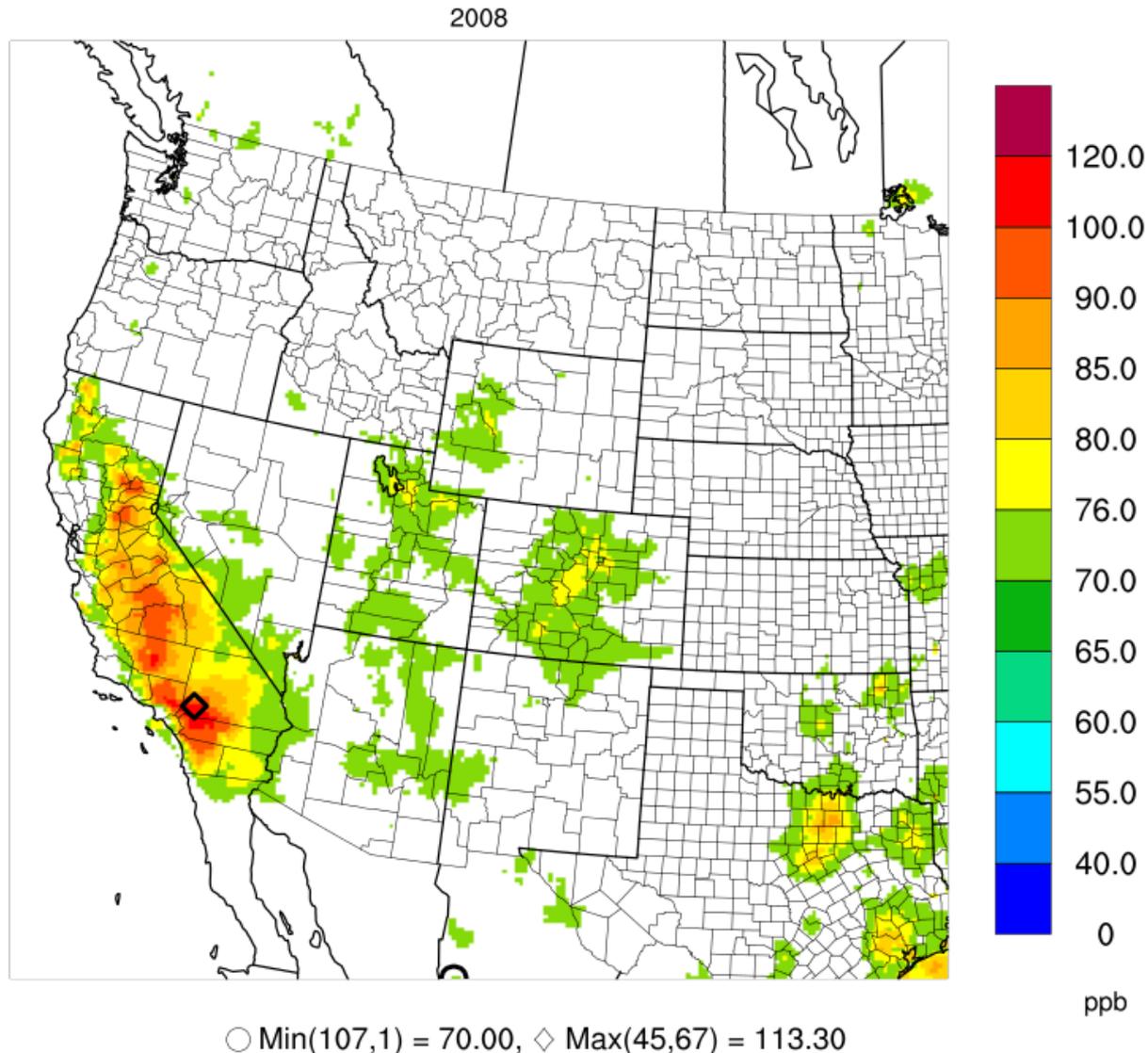
- June 20, 2013: 2008 Database Development
- July 26, 2013: State-Specific Source Apportionment
- August 29, 2013: Source Category-Specific Source Apportionment
- [Interactive agenda from WestJumpAQMS Final Project Report meeting](#), Denver, CO – September 25, 2013
- **Presentations and all project materials at:**  
<http://www.wrapair2.org/WestJumpAQMS.aspx>

# Ozone Attainment Test Software – Unmonitored Area Analysis with Design Value (2006-2010) $\geq 76$ ppb

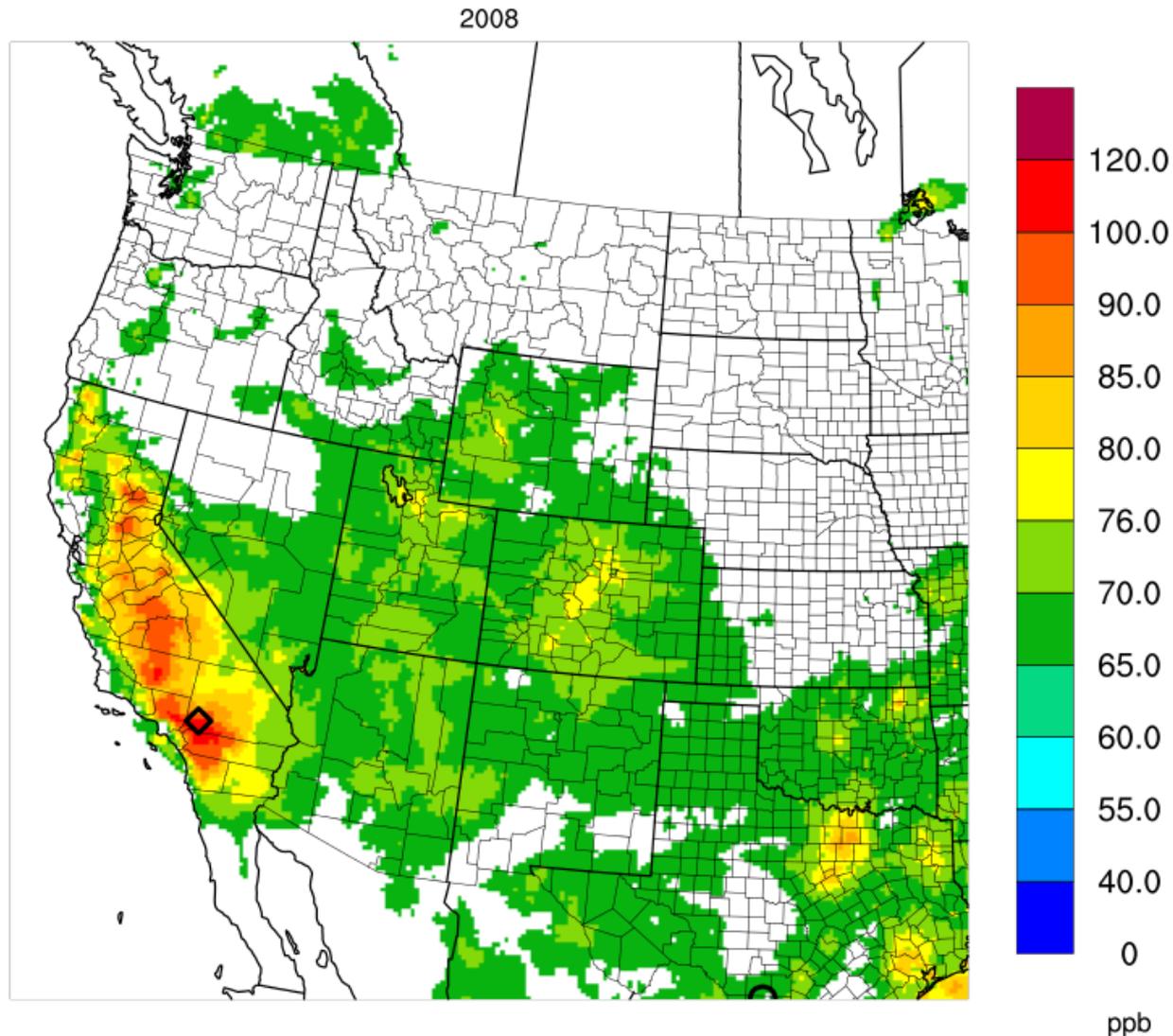


○ Min(210,3) = 76.00, ◇ Max(45,67) = 113.30

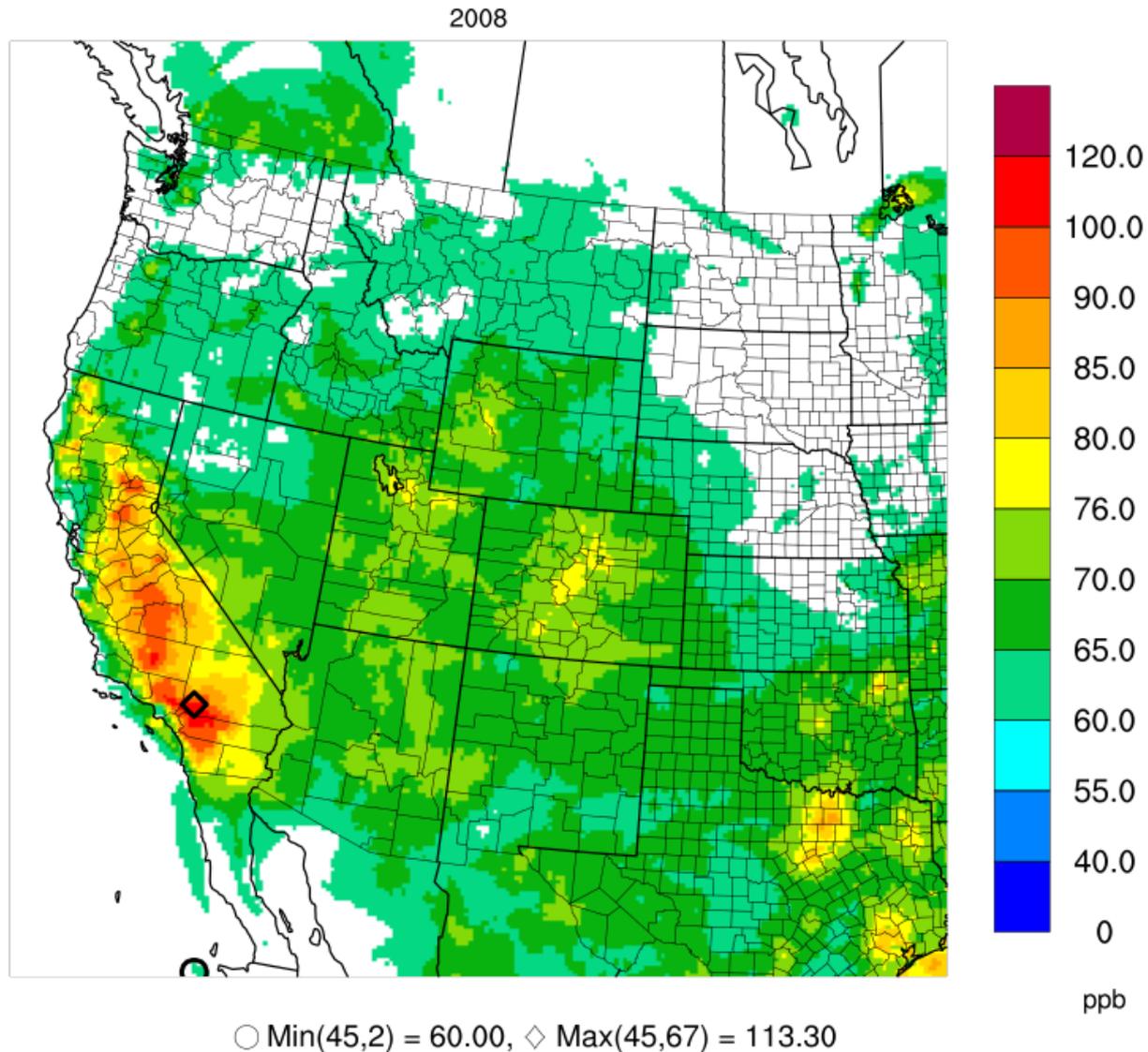
# Ozone Attainment Test Software – Unmonitored Area Analysis with Design Value (2006-2010) $\geq 70$ ppb



# Attainment Test Software – Unmonitored Area Analysis with Design Value (2006-2010) $\geq 65$ ppb



# Ozone Attainment Test Software – Unmonitored Area Analysis with Design Value (2006-2010) $\geq 60$ ppb

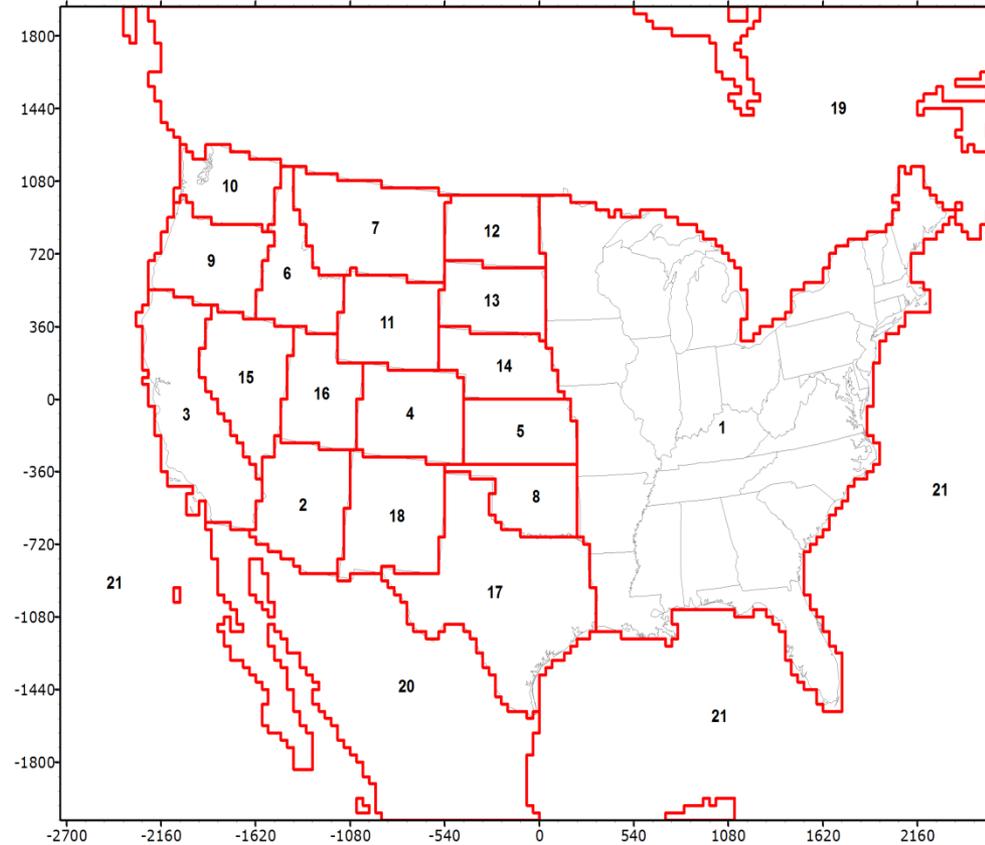


# State-Specific Ozone Source Apportionment

- Purpose: To provide information on the role of ozone transport to exceedances of the current and potential future ozone NAAQS in the western U.S.
- Approach: Analyze ozone apportionment several ways:
  1. Upwind state contribution to downwind state nonattainment using Cross State Air Pollution Rule (CSAPR-type) approach
    - Use EPA method for projecting ozone Design Values (RRFs)
  2. State contributions to modeled high ozone DMAX8 ozone at monitors in 12 km WESTUS domain
    - Spatial extent of modeled state contributions to 1stmax and 4thmax DMAX8 ozone greater than current and potential future NAAQS
    - Source category analysis (Natural, Fires & Anthropogenic)
  3. Detailed Source Category-Specific Source Apportionment
    - 6 key source categories across 4 states in intermountain West
    - 2-way nesting between model domains

# State-Specific Ozone Source Apportionment

- 2008 36/12 km Base
- 17 Western States
  - Plus EasternUS, Can, Mex & Off-Shore
- 5 Source Categories
  - Natural  
(Biogenics+Lightning+WBDust+SeaSalt)
  - WF, Rx and Ag Fires
  - Anthropogenic
- 107 Source Groups (21 x 5 + 2)
  - 4 Extra Species for each Group
    - 428 additional species
    - Standard Model = 70 species
    - Computationally Demanding



# CSAPR-Type Analysis for Current (76 ppb) NAAQS

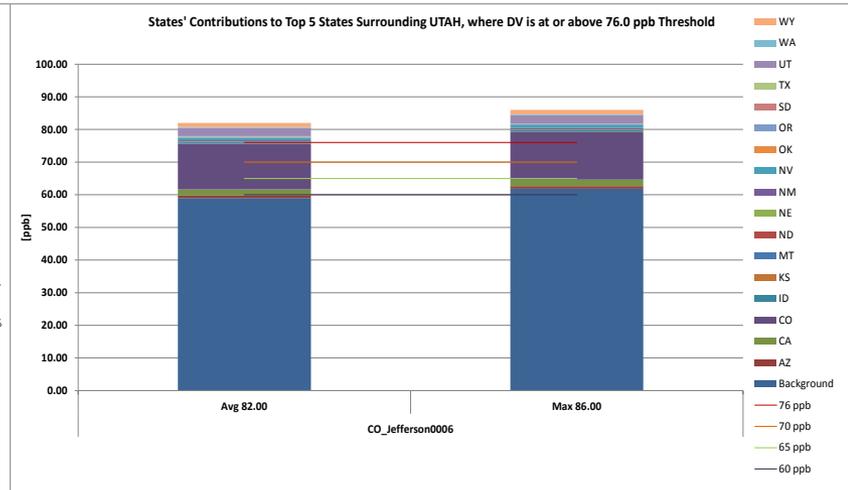
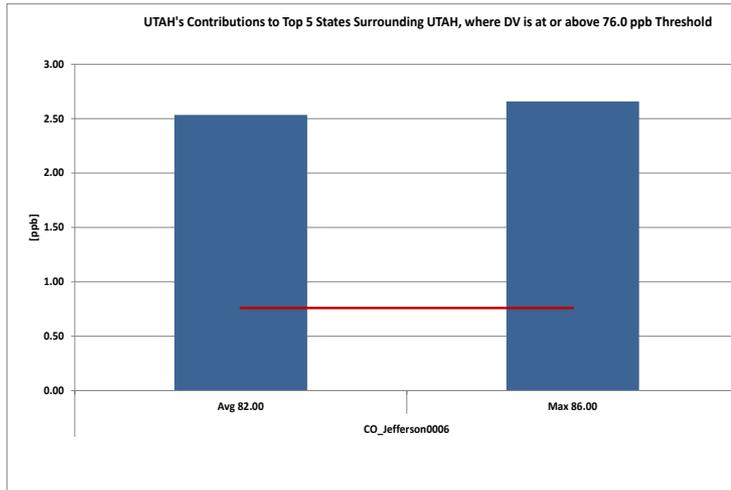
- CSAPR looked at contributions to:
  - Average Design Value = Average of DVs from 2006-2010
  - Max Design Values = Max DVs from 2006-2010
- 136 ozone monitors in 12 km WESTUS domain with Average Design Value exceeding NAAQS
  - 86 sites (63%) in California
- For 17 upwind western states examine 2008 contribution to DMAX8 ozone Design Value in downwind states
  - CSAPR used a 1% NAAQS significance threshold ( $\geq 0.76$  ppb)
- This analysis is for 2008 and is not a regulatory analysis that would have to examine a future year

# UT CSAPR-Type Ozone Analysis for 76 & 65 ppb NAAQS (from WestJumpAQMS Appendix A)

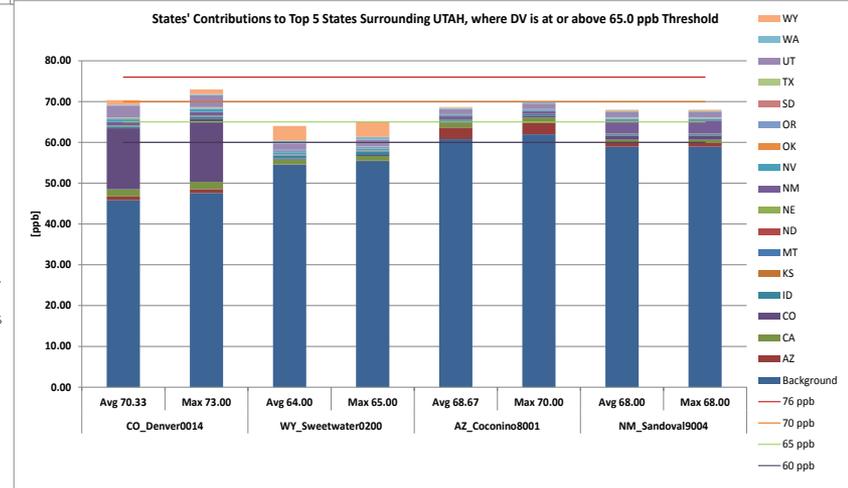
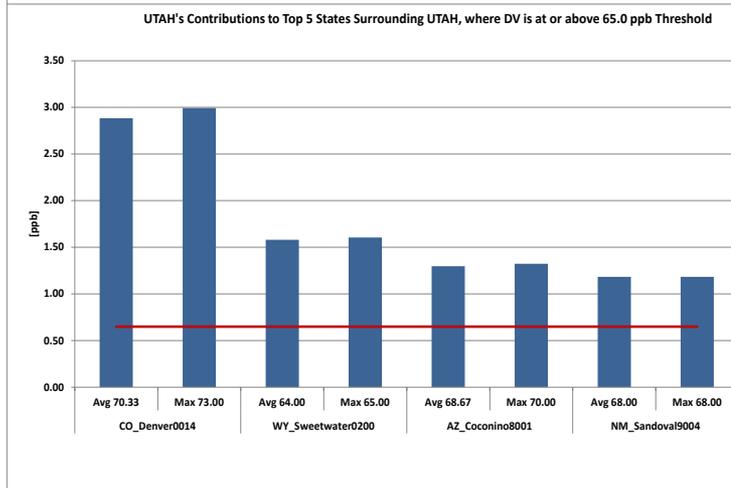
## Utah Ozone Contributions

## Downwind State Design Values

76 ppb



65 ppb



# State Contributions to Modeled 10 Highest DMAX8 Ozone Days (from WestJumpAQMS Appendix B)

**Highest Modeled DMAX8 Day @ Desert View Elementary School in Sunland Park, NM**

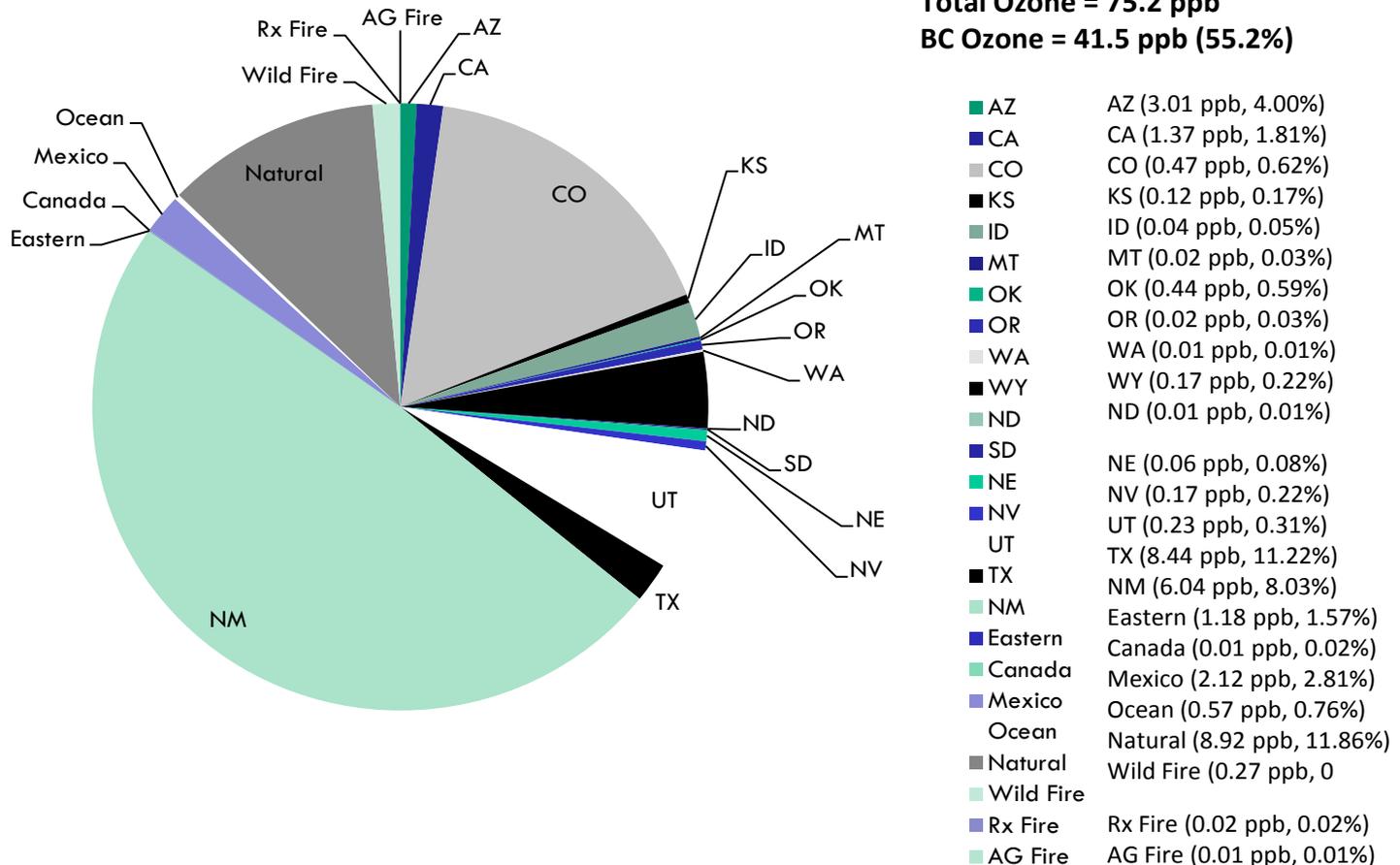
## Contributions to MDA8 Ozone [ppb]

Site: NM\_Dona Ana0021

Rank: 1 - 10 Aug, 2008

Total Ozone = 75.2 ppb

BC Ozone = 41.5 ppb (55.2%)



# State Contributions to Modeled 10 Highest DMAX8 Ozone Days (from WestJumpAQMS Appendix B)

4<sup>th</sup> Highest Modeled DMAX8 Day @ Desert View Elementary School in Sunland Park, NM

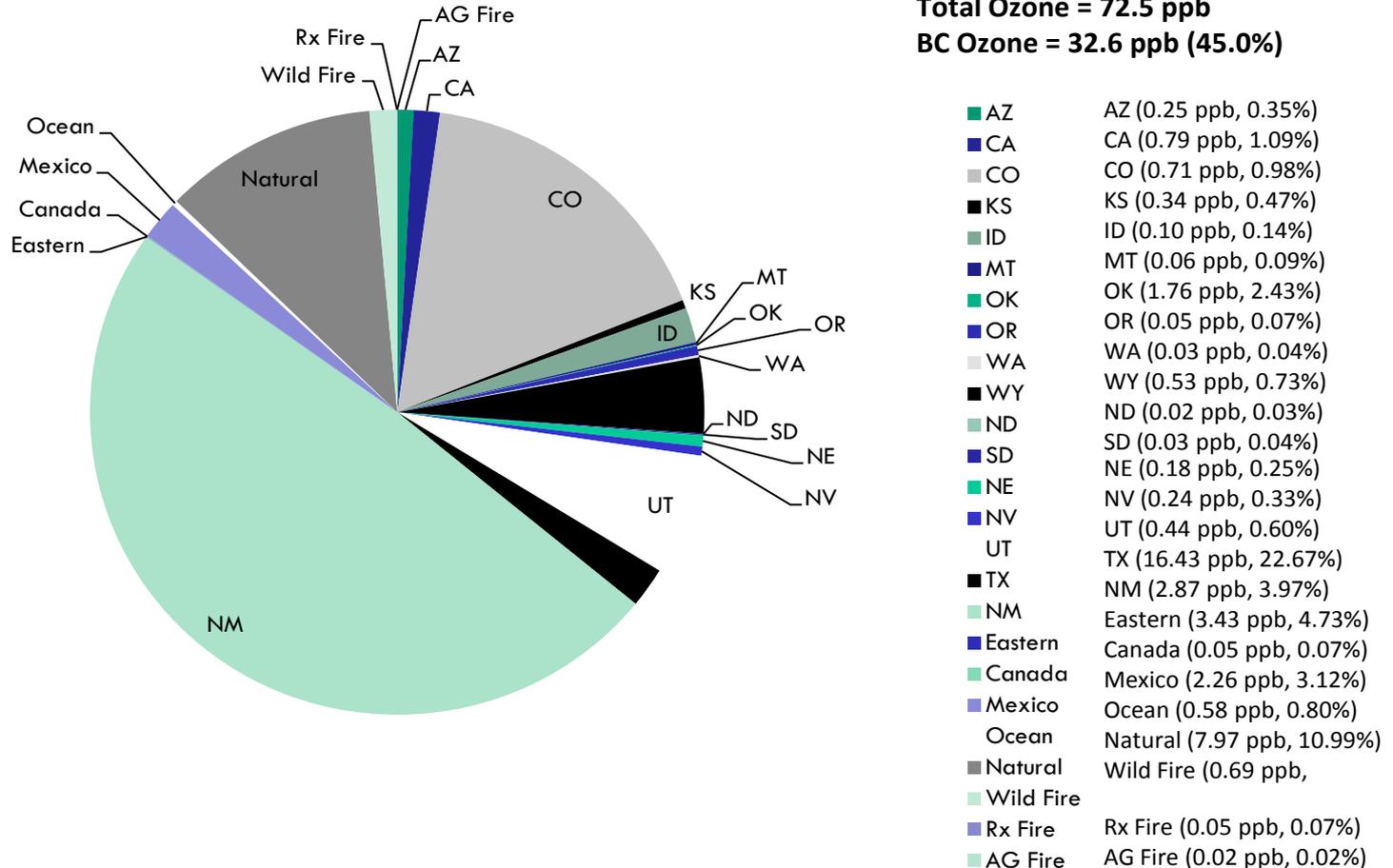
## Contributions to MDA8 Ozone [ppb]

Site: NM\_Dona Ana0021

Rank: 4 - 07 Aug, 2008

Total Ozone = 72.5 ppb

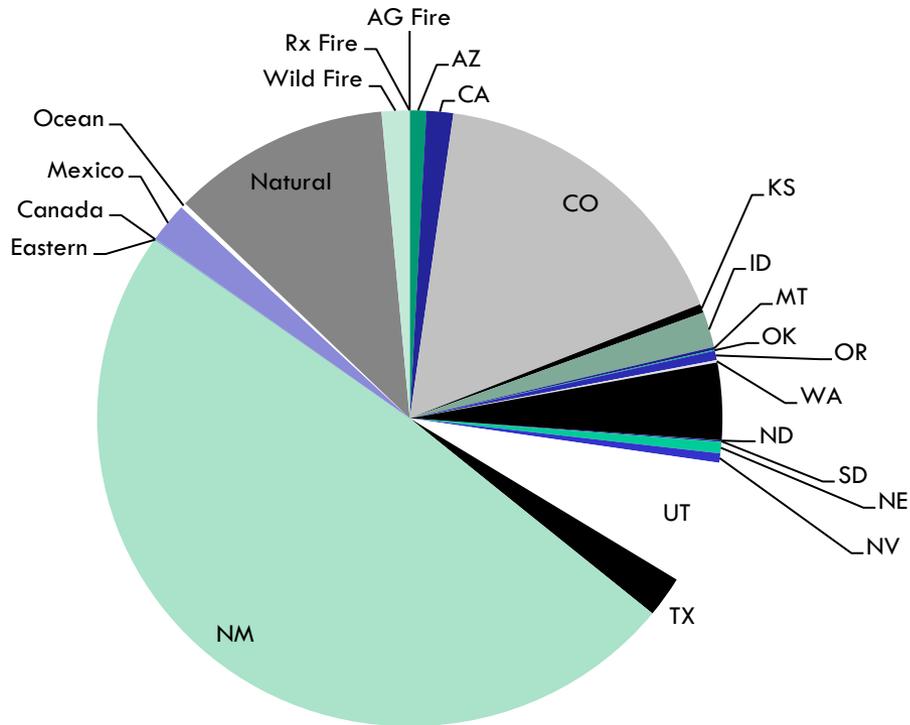
BC Ozone = 32.6 ppb (45.0%)



# State Contributions to Modeled 10 Highest DMAX8 Ozone Days (from WestJumpAQMS Appendix B)

**10<sup>th</sup> Highest Modeled DMAX8 Day @ Desert View Elementary School in Sunland Park, NM**

## Contributions to MDA8 Ozone [ppb]



Site: NM\_Dona Ana0021

Rank: 10 - 06 Aug, 2008

Total Ozone = 70.3 ppb

BC Ozone = 32.6 ppb (46.4%)

AZ	AZ (0.28 ppb, 0.40%)
CA	CA (1.03 ppb, 1.47%)
CO	CO (0.78 ppb, 1.11%)
KS	KS (0.43 ppb, 0.61%)
ID	ID (0.15 ppb, 0.21%)
MT	MT (0.09 ppb, 0.13%)
OK	OK (0.86 ppb, 1.22%)
OR	OR (0.07 ppb, 0.10%)
WA	WA (0.03 ppb, 0.05%)
WY	WY (0.75 ppb, 1.07%)
ND	ND (0.02 ppb, 0.03%)
SD	SD (0.23 ppb, 0.33%)
NE	NE (0.32 ppb, 0.46%)
NV	NV (0.57 ppb, 0.81%)
UT	UT (0.57 ppb, 0.81%)
TX	TX (17.55 ppb, 24.96%)
NM	NM (7.60 ppb, 10.80%)
Eastern	Eastern (2.73 ppb, 3.89%)
Canada	Canada (0.05 ppb, 0.07%)
Mexico	Mexico (2.40 ppb, 3.42%)
Ocean	Ocean (0.23 ppb, 0.33%)
Natural	Natural (7.60 ppb, 10.80%)
Wild Fire	Wild Fire (0.94 ppb, 1.34%)
Rx Fire	Rx Fire (0.05 ppb, 0.07%)
AG Fire	AG Fire (0.02 ppb, 0.03%)

# State Contributions to Modeled 10 Highest DMAX8 Ozone Days (from WestJumpAQMS Appendix B)

**Highest Modeled DMAX8 Day @ Double Eagle Elementary School, Albuquerque, NM**

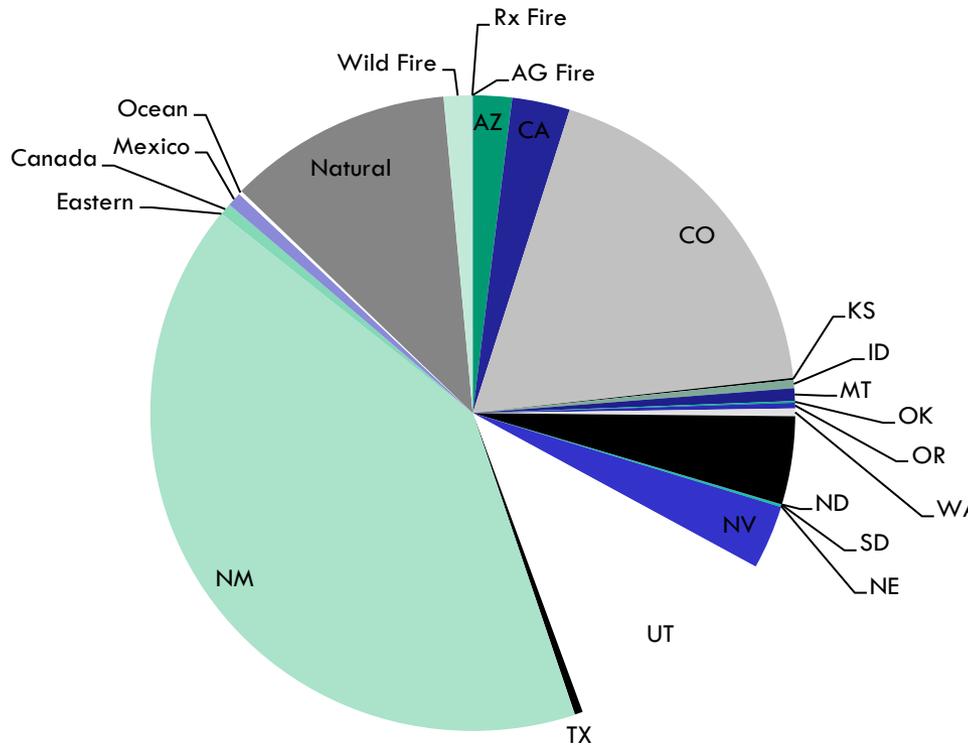
## Contributions to MDA8 Ozone [ppb]

Site: NM\_Bernalillo1012

Rank: 1 - 02 May, 2008

Total Ozone = 78.5 ppb

BC Ozone = 68.9 ppb (87.7%)



AZ	AZ (0.02 ppb, 0.02%)
CA	CA (0.17 ppb, 0.22%)
CO	CO (0.23 ppb, 0.30%)
KS	KS (0.01 ppb, 0.01%)
ID	ID (0.86 ppb, 1.10%)
MT	MT (0.26 ppb, 0.34%)
OK	OK (0.01 ppb, 0.01%)
OR	OR (0.58 ppb, 0.74%)
WA	WA (0.69 ppb, 0.87%)
WY	WY (0.43 ppb, 0.54%)
ND	ND (0.01 ppb, 0.01%)
SD	SD (0.00 ppb, 0.01%)
NE	NE (0.01 ppb, 0.01%)
NV	NV (0.09 ppb, 0.11%)
UT	UT (2.87 ppb, 3.65%)
TX	TX (0.02 ppb, 0.03%)
NM	NM (1.85 ppb, 2.35%)
Eastern	Eastern (0.04 ppb, 0.05%)
Canada	Canada (0.10 ppb, 0.12%)
Mexico	Mexico (0.01 ppb, 0.01%)
Ocean	Ocean (0.10 ppb, 0.13%)
Natural	Natural (1.28 ppb, 1.63%)
Wild Fire	Wild Fire (0.02 ppb, 0.0)
Rx Fire	Rx Fire (0.03 ppb, 0.03%)
AG Fire	AG Fire (0.00 ppb, 0.00%)

# State Contributions to Modeled 10 Highest DMAX8 Ozone Days (from WestJumpAQMS Appendix B)

4<sup>th</sup> Highest Modeled DMAX8 Day @ Double Eagle Elementary School, Albuquerque, NM

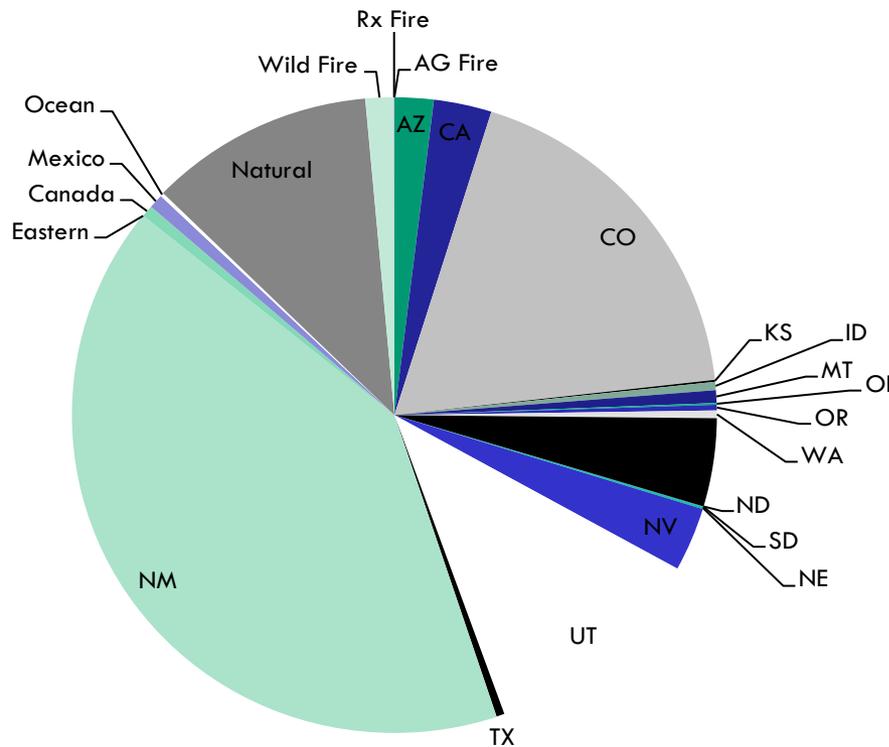
## Contributions to MDA8 Ozone [ppb]

Site: NM\_Bernalillo1012

Rank: 4 - 12 Apr, 2008

Total Ozone = 72.9 ppb

BC Ozone = 63.7 ppb (87.3%)



AZ	AZ (0.04 ppb, 0.06%)
CA	CA (0.21 ppb, 0.29%)
CO	CO (1.71 ppb, 2.35%)
KS	KS (0.00 ppb, 0.00%)
ID	ID (0.63 ppb, 0.87%)
MT	MT (0.44 ppb, 0.61%)
OK	OK (0.00 ppb, 0.00%)
OR	OR (0.38 ppb, 0.52%)
WA	WA (0.71 ppb, 0.98%)
WY	WY (1.18 ppb, 1.62%)
ND	ND (0.00 ppb, 0.00%)
SD	SD (0.00 ppb, 0.00%)
NE	NE (0.00 ppb, 0.01%)
NV	NV (0.12 ppb, 0.16%)
UT	UT (0.70 ppb, 0.95%)
TX	TX (2.00 ppb, 2.74%)
NM	NM (2.10 ppb, 2.88%)
Eastern	Eastern (0.00 ppb, 0.00%)
Canada	Canada (0.17 ppb, 0.23%)
Mexico	Mexico (0.01 ppb, 0.01%)
Ocean	Ocean (0.08 ppb, 0.10%)
Natural	Natural (0.71 ppb, 0.98%)
Wild Fire	Wild Fire (0.00 ppb, 0.00%)
Rx Fire	Rx Fire (0.01 ppb, 0.01%)
AG Fire	AG Fire (0.00 ppb, 0.00%)

# State Contributions to Modeled 10 Highest DMAX8 Ozone Days (from WestJumpAQMS Appendix B)

**10<sup>th</sup> Highest Modeled DMAX8 Day @ Double Eagle Elementary School, Albuquerque, NM**

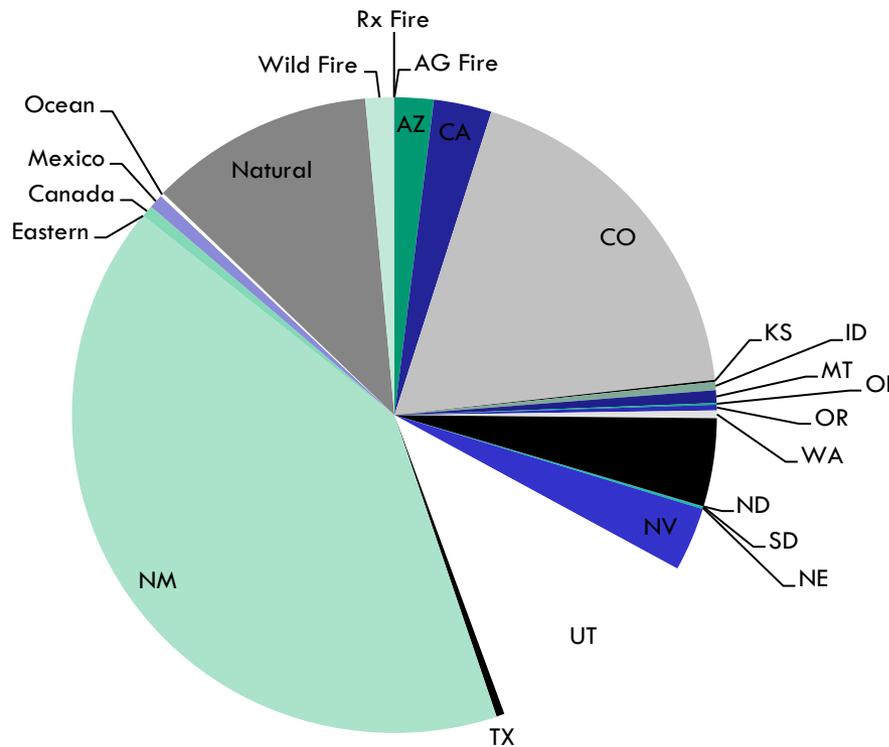
## Contributions to MDA8 Ozone [ppb]

Site: NM\_Bernalillo1012

Rank: 10 - 02 Jul, 2008

Total Ozone = 71.3 ppb

BC Ozone = 47.9 ppb (67.2%)



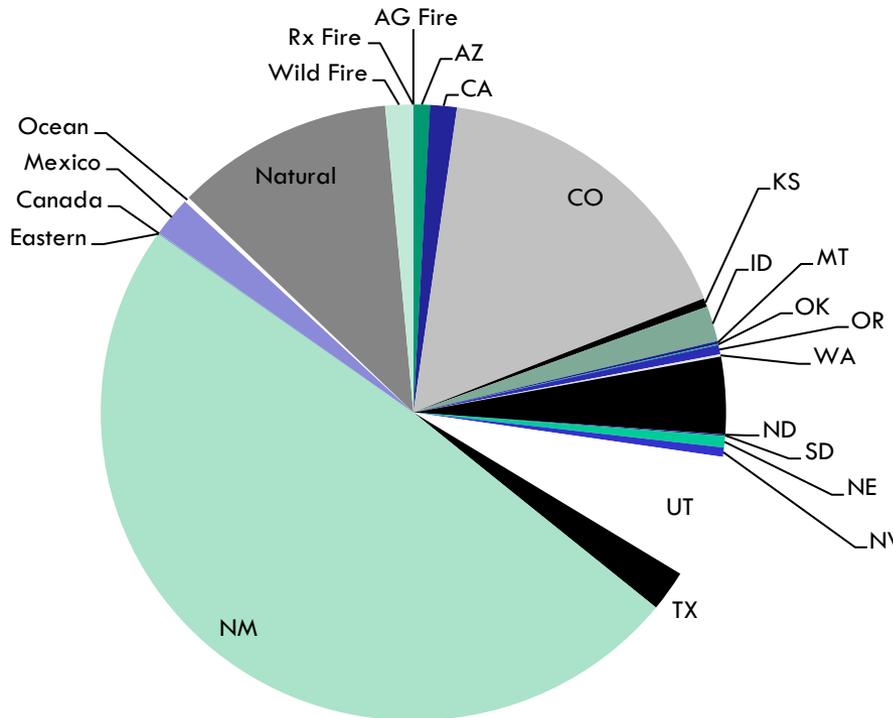
AZ	AZ (0.46 ppb, 0.64%)
CA	CA (0.68 ppb, 0.95%)
CO	CO (4.31 ppb, 6.04%)
KS	KS (0.02 ppb, 0.03%)
ID	ID (0.10 ppb, 0.14%)
MT	MT (0.15 ppb, 0.21%)
OK	OK (0.02 ppb, 0.03%)
OR	OR (0.07 ppb, 0.09%)
WA	WA (0.09 ppb, 0.13%)
WY	WY (1.05 ppb, 1.47%)
ND	ND (0.00 ppb, 0.00%)
SD	SD (0.01 ppb, 0.01%)
NE	NE (0.03 ppb, 0.04%)
NV	NV (0.76 ppb, 1.06%)
UT	UT (2.68 ppb, 3.76%)
TX	TX (0.10 ppb, 0.13%)
NM	NM (9.59 ppb, 13.44%)
Eastern	Eastern (0.00 ppb, 0.00%)
Canada	Canada (0.14 ppb, 0.20%)
Mexico	Mexico (0.17 ppb, 0.24%)
Ocean	Ocean (0.04 ppb, 0.06%)
Natural	Natural (2.64 ppb, 3.70%)
Wild Fire	Wild Fire (0.33 ppb, 0.46%)
Rx Fire	Rx Fire (0.01 ppb, 0.01%)
AG Fire	AG Fire (0.00 ppb, 0.00%)

# State Contributions to Modeled 10 Highest DMAX8 Ozone Days (from WestJumpAQMS Appendix B)

## Highest Modeled DMAX8 Day in Carlsbad, NM

### Contributions to MDA8 Ozone [ppb]

Site: NM\_Eddy1005  
 Rank: 1 - 28 Feb, 2008  
 Total Ozone = 75.1 ppb  
 BC Ozone = 66.2 ppb (88.1%)



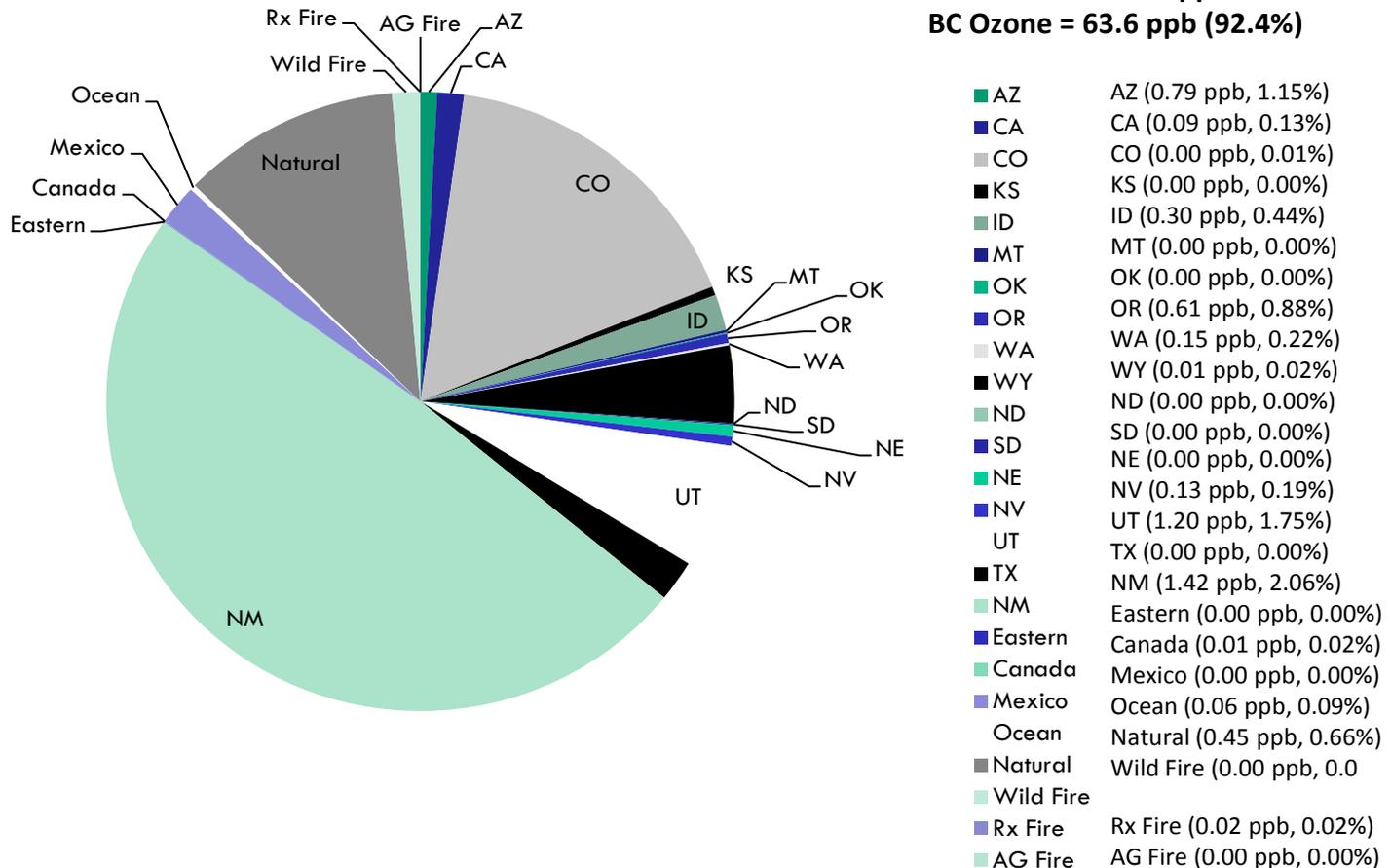
AZ	AZ (0.16 ppb, 0.22%)
CA	CA (0.36 ppb, 0.48%)
CO	CO (0.19 ppb, 0.25%)
KS	KS (0.03 ppb, 0.03%)
ID	ID (0.08 ppb, 0.10%)
MT	MT (0.10 ppb, 0.13%)
OK	OK (0.02 ppb, 0.03%)
OR	OR (0.03 ppb, 0.04%)
WA	WA (0.02 ppb, 0.02%)
WY	WY (0.18 ppb, 0.24%)
ND	ND (0.03 ppb, 0.04%)
SD	SD (0.06 ppb, 0.08%)
NE	NE (0.08 ppb, 0.11%)
NV	NV (0.08 ppb, 0.11%)
UT	UT (0.34 ppb, 0.46%)
TX	TX (1.51 ppb, 2.01%)
NM	NM (1.69 ppb, 2.25%)
Eastern	Eastern (0.00 ppb, 0.00%)
Canada	Canada (0.06 ppb, 0.08%)
Mexico	Mexico (3.52 ppb, 4.69%)
Ocean	Ocean (0.04 ppb, 0.06%)
Natural	Natural (0.22 ppb, 0.29%)
Wild Fire	Wild Fire (0.10 ppb, 0.1)
Rx Fire	Rx Fire (0.07 ppb, 0.09%)
AG Fire	AG Fire (0.03 ppb, 0.04%)

# State Contributions to Modeled 10 Highest DMAX8 Ozone Days (from WestJumpAQMS Appendix B)

## 4<sup>th</sup> Highest Modeled DMAX8 Day in Carlsbad, NM

### Contributions to MDA8 Ozone [ppb]

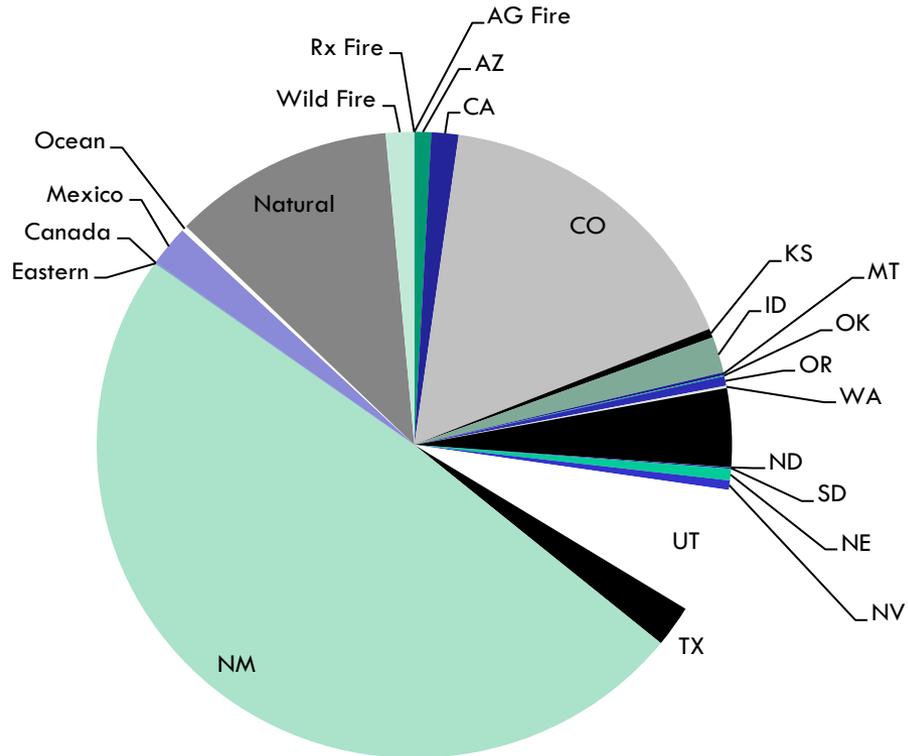
Site: NM\_Eddy1005  
 Rank: 4 - 11 Apr, 2008  
 Total Ozone = 68.9 ppb  
 BC Ozone = 63.6 ppb (92.4%)



# State Contributions to Modeled 10 Highest DMAX8 Ozone Days (from WestJumpAQMS Appendix B)

## 10<sup>th</sup> Highest Modeled DMAX8 Day in Carlsbad, NM

### Contributions to MDA8 Ozone [ppb]



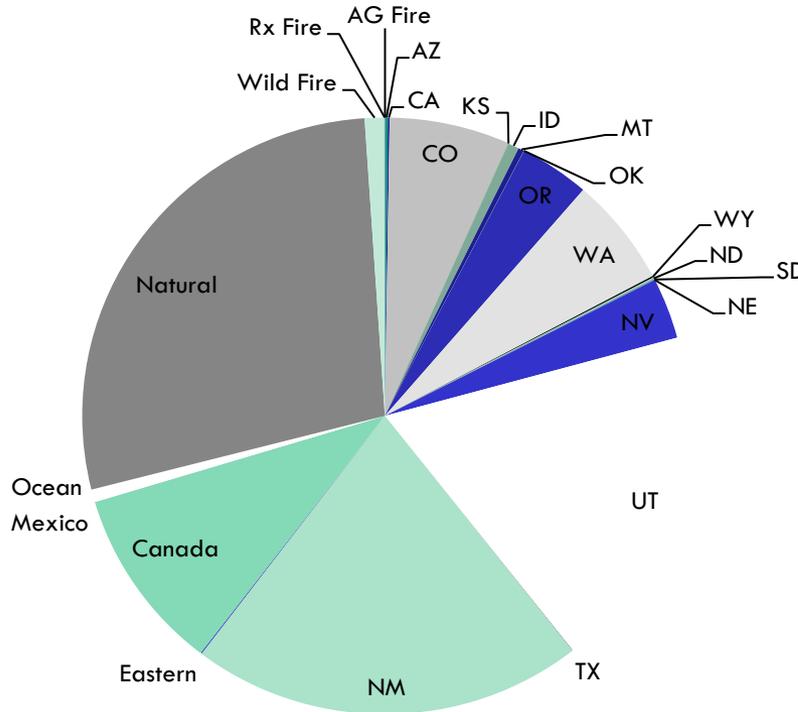
Site: NM\_Eddy1005  
 Rank: 10 - 12 Aug, 2008  
 Total Ozone = 66.0 ppb  
 BC Ozone = 40.3 ppb (61.1%)

AZ	AZ (0.65 ppb, 0.98%)
CA	CA (1.32 ppb, 2.00%)
CO	CO (1.90 ppb, 2.88%)
KS	KS (0.54 ppb, 0.82%)
ID	ID (0.07 ppb, 0.10%)
MT	MT (0.04 ppb, 0.05%)
OK	OK (0.85 ppb, 1.28%)
OR	OR (0.02 ppb, 0.02%)
WA	WA (0.01 ppb, 0.01%)
WY	WY (0.59 ppb, 0.89%)
ND	ND (0.01 ppb, 0.02%)
SD	SD (0.14 ppb, 0.21%)
NE	NE (0.41 ppb, 0.63%)
NV	NV (0.73 ppb, 1.10%)
UT	UT (5.10 ppb, 7.72%)
TX	TX (4.64 ppb, 7.03%)
NM	NM (6.86 ppb, 10.39%)
Eastern	Eastern (0.49 ppb, 0.74%)
Canada	Canada (0.02 ppb, 0.04%)
Mexico	Mexico (0.92 ppb, 1.40%)
Ocean	Ocean (0.22 ppb, 0.34%)
Natural	Natural (6.86 ppb, 10.39%)
Wild Fire	Wild Fire (0.15 ppb, 0.23%)
Rx Fire	Rx Fire (0.01 ppb, 0.01%)
AG Fire	AG Fire (0.00 ppb, 0.01%)

# State Contributions to Modeled 10 Highest DMAX8 Ozone Days (from WestJumpAQMS Appendix B)

## Highest Modeled DMAX8 Day @ Navajo Lake, NM

### Contributions to MDA8 Ozone [ppb]



Site: NM\_San Juan0018

Rank: 1 - 13 Jun, 2008

Total Ozone = 79.3 ppb

BC Ozone = 69.8 ppb (88.0%)

AZ	AZ (0.01 ppb, 0.02%)
CA	CA (0.01 ppb, 0.01%)
CO	CO (0.61 ppb, 0.77%)
KS	KS (0.00 ppb, 0.00%)
ID	ID (0.06 ppb, 0.07%)
MT	MT (0.03 ppb, 0.04%)
OK	OK (0.00 ppb, 0.00%)
OR	OR (0.36 ppb, 0.45%)
WA	WA (0.56 ppb, 0.71%)
WY	WY (0.01 ppb, 0.01%)
ND	ND (0.01 ppb, 0.01%)
SD	SD (0.00 ppb, 0.00%)
NE	NE (0.00 ppb, 0.00%)
NV	NV (0.32 ppb, 0.40%)
UT	UT (1.78 ppb, 2.24%)
TX	TX (0.00 ppb, 0.00%)
NM	NM (2.00 ppb, 2.52%)
Eastern	Eastern (0.01 ppb, 0.01%)
Canada	Canada (0.95 ppb, 1.20%)
Mexico	Mexico (0.00 ppb, 0.00%)
Ocean	Ocean (0.07 ppb, 0.08%)
Natural	Natural (2.66 ppb, 3.36%)
Wild Fire	Wild Fire (0.10 ppb, 0.1)
Rx Fire	Rx Fire (0.00 ppb, 0.00%)
AG Fire	AG Fire (0.00 ppb, 0.00%)

# State Contributions to Modeled 10 Highest DMAX8 Ozone Days (from WestJumpAQMS Appendix B)

## 4<sup>th</sup> Highest Modeled DMAX8 Day @ Navajo Lake, NM

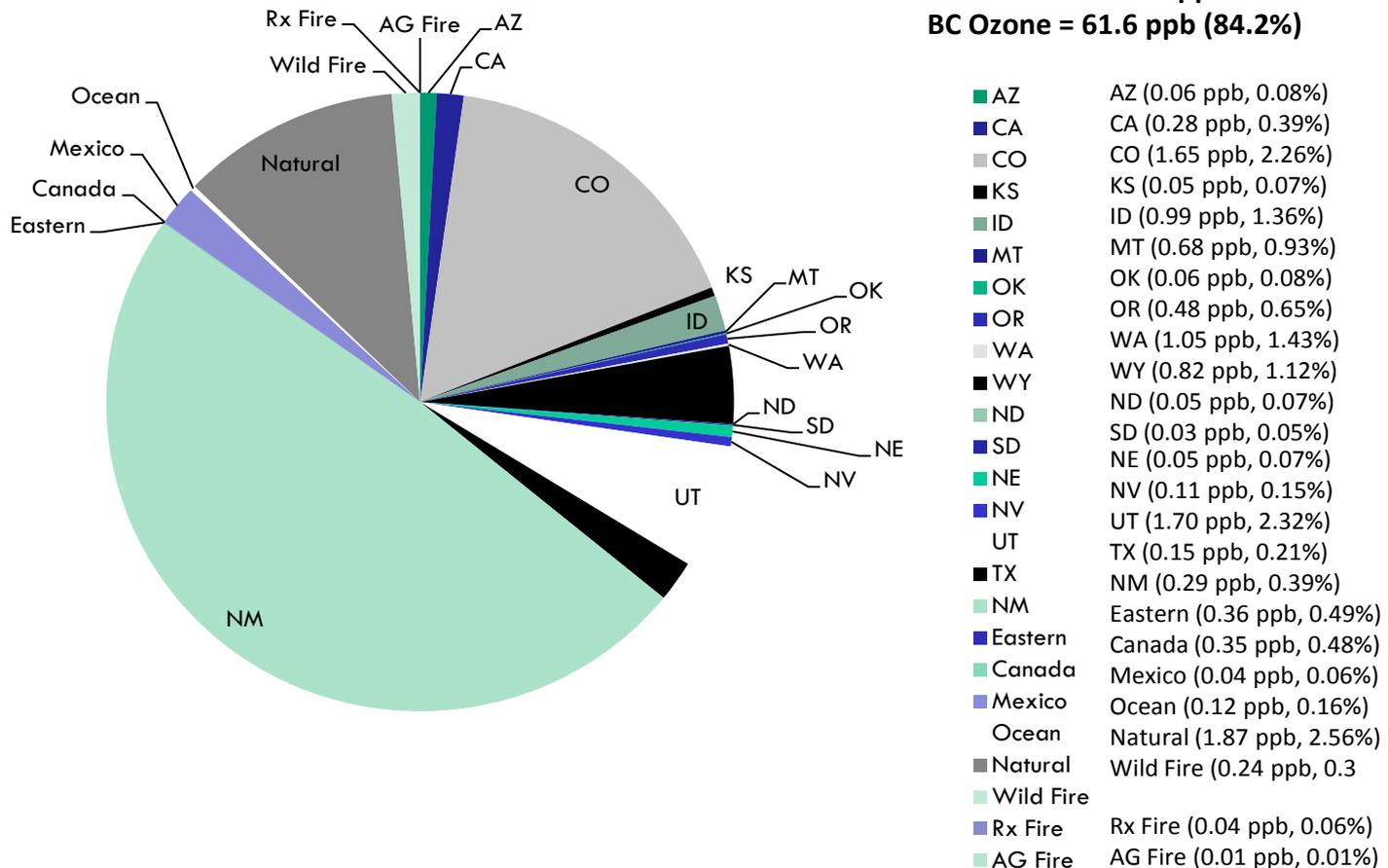
### Contributions to MDA8 Ozone [ppb]

Site: NM\_San Juan0018

Rank: 4 - 02 May, 2008

Total Ozone = 73.2 ppb

BC Ozone = 61.6 ppb (84.2%)

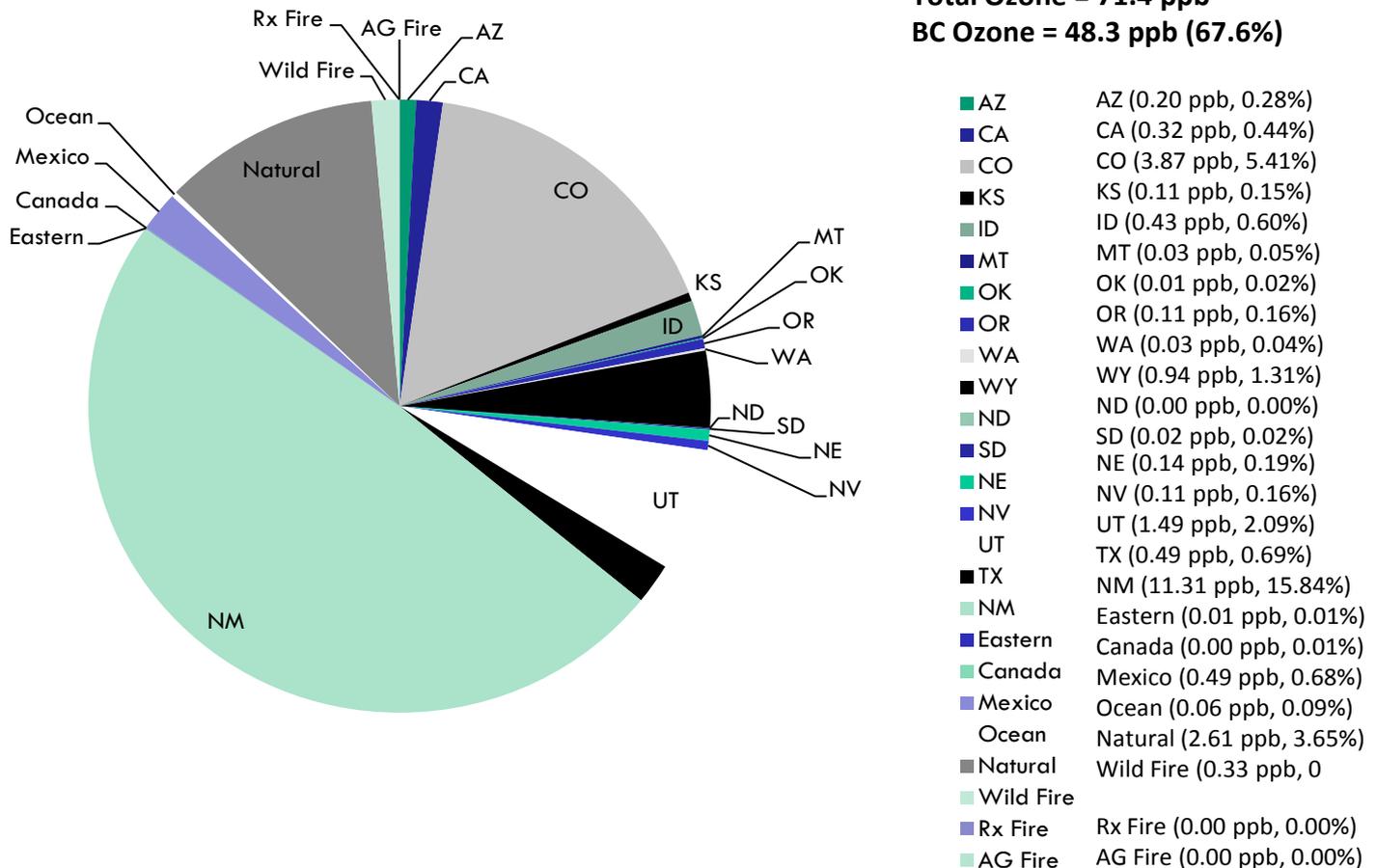


# State Contributions to Modeled 10 Highest DMAX8 Ozone Days (from WestJumpAQMS Appendix B)

## 10<sup>th</sup> Highest Modeled DMAX8 Day @ Navajo Lake, NM

### Contributions to MDA8 Ozone [ppb]

Site: NM\_San Juan0018  
 Rank: 10 - 10 Jul, 2008  
 Total Ozone = 71.4 ppb  
 BC Ozone = 48.3 ppb (67.6%)



# Spatial Distribution of State Ozone Contributions

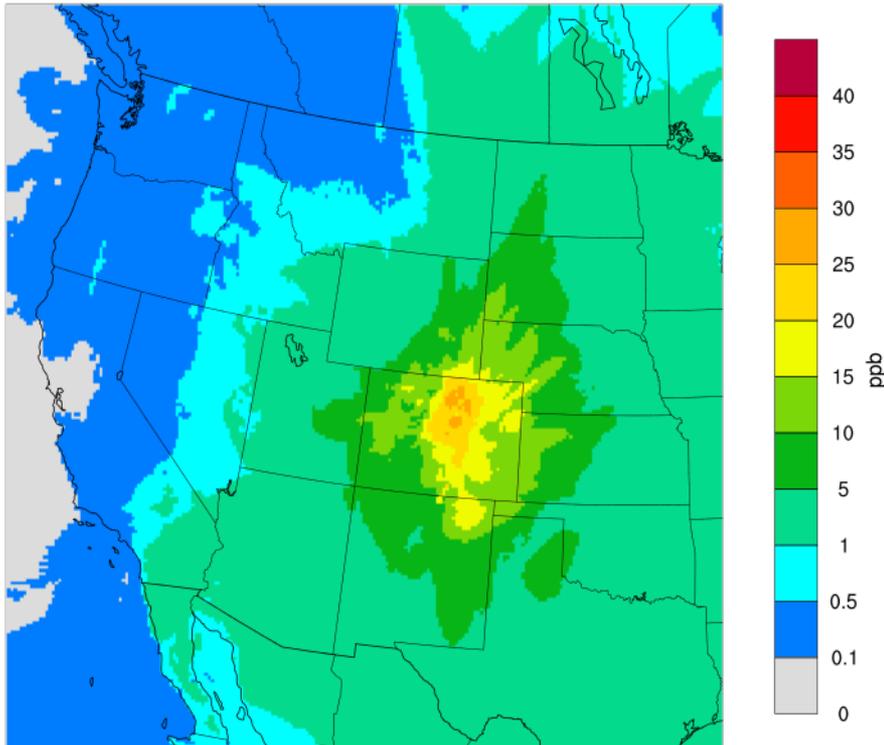
- Spatial distribution of state's ozone contribution to DMAX8 ozone concentrations greater than or equal to:
  - 76 ppb (current NAAQS)
  - 70 ppb; 65 ppb and 60 ppb (potential future NAAQS)
  - 0 ppb (highest contribution in year)
- Two types of metrics:
  1. Maximum modeled contribution to Highest and 4<sup>th</sup> Highest DMAX8 ozone (from WestJumpAQMS Appendix C)
  2. Attainment Test Unmonitored Areas projection contribution to 8-hour ozone design value
- Examples for Colorado next:
  - Maximum contribution to highest DMAX8 ever and design value
  - Maximum contribution to 4<sup>th</sup> high DMAX8 for 76 and 65 ppb

# 2008 Colorado 8-Hour Ozone Contribution

Highest Modeled Contribution

Attainment Test Design Value Contribution

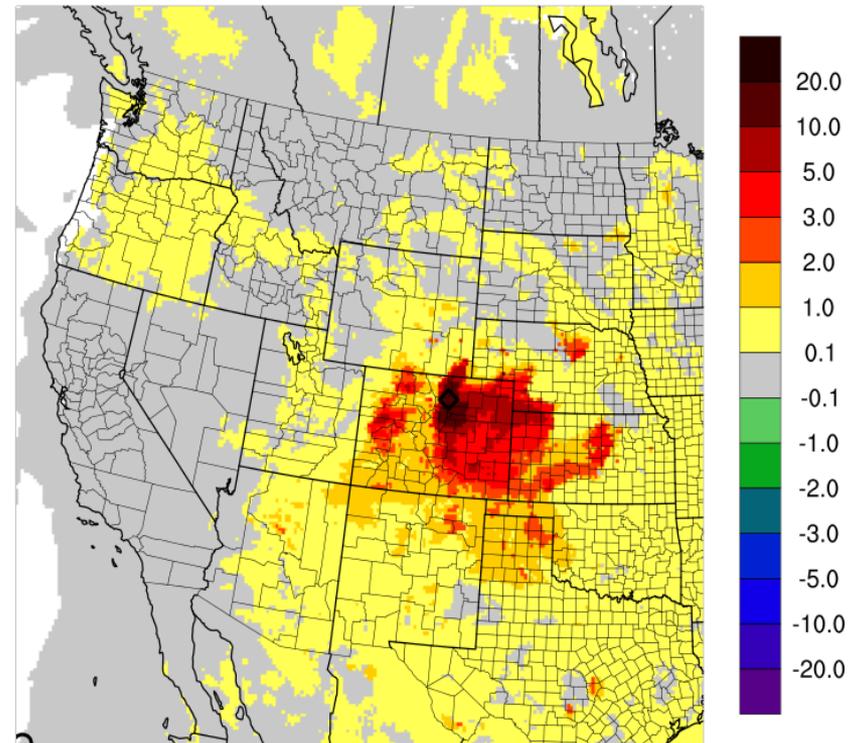
Contrib. to CAMx Daily Max 8-Hour Ozone  $\geq 0$  ppb  
CO Anthropogenic Max Contribution



Max(144,110) = 29.18

CO

2008



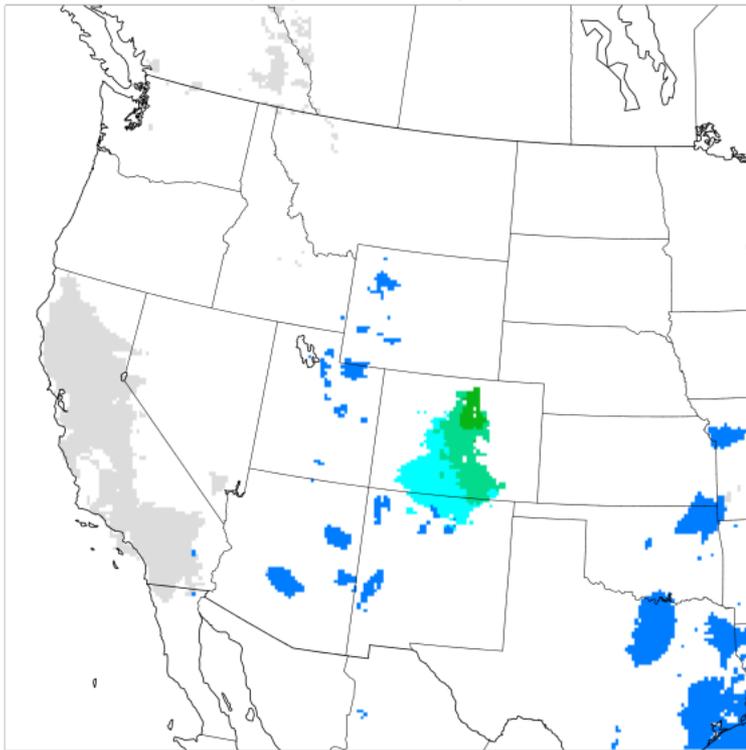
○ Min(3,1) = 0.00, ◇ Max(142,107) = 17.60

# Colorado Max Contribution to 4<sup>th</sup> High DMAX8 Ozone

DMAX8 Ozone  $\geq$  76 ppb

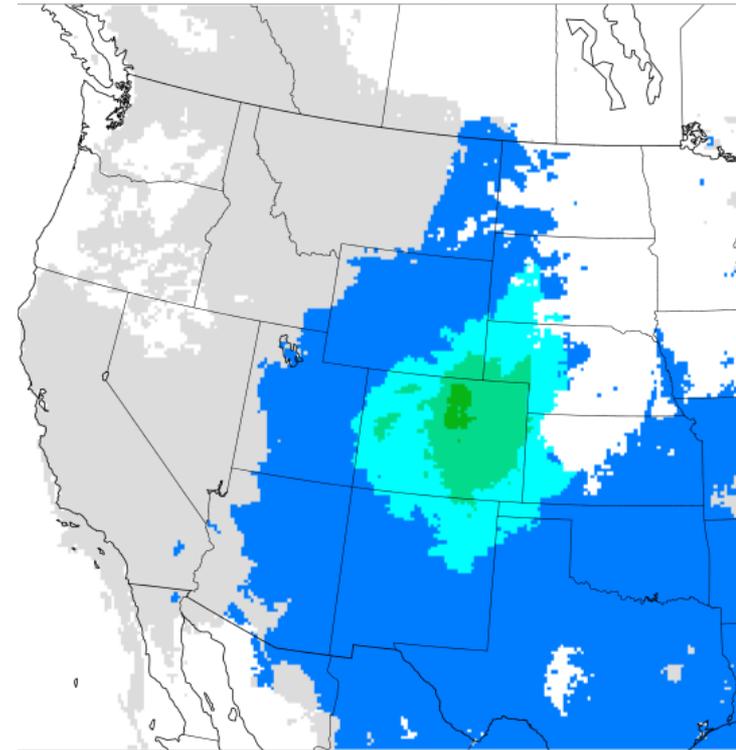
DMAX8 Ozone  $\geq$  65 ppb

**Contrib. to CAMx Daily Max 8-Hour Ozone  $\geq$  76 ppb**  
CO Anthropogenic 4th Highest Contribution



Max(142,109) = 24.25

**Contrib. to CAMx Daily Max 8-Hour Ozone  $\geq$  65 ppb**  
CO Anthropogenic 4th Highest Contribution



Max(142,109) = 24.25

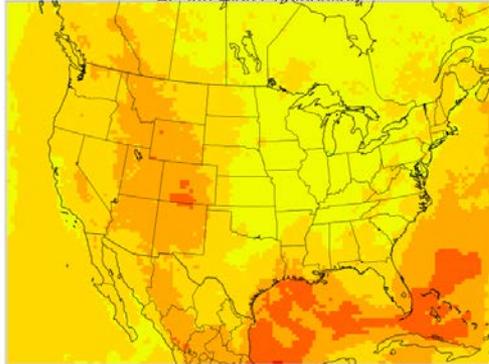
# “Other Sources” Max Contrib. 4<sup>th</sup> High DMAX8 Ozone

Boundary Conditions

Natural

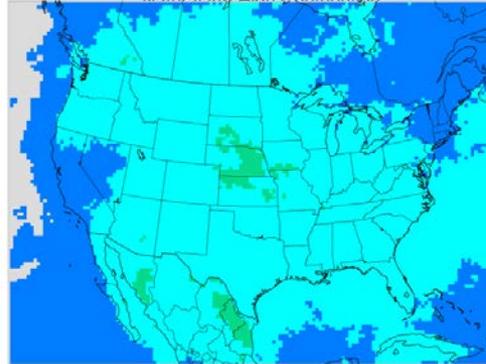
Anthropogenic

Contrib. to CAMx Daily Max 8-Hour Ozone  $\geq 0$  ppb  
BC 4th High Contribution



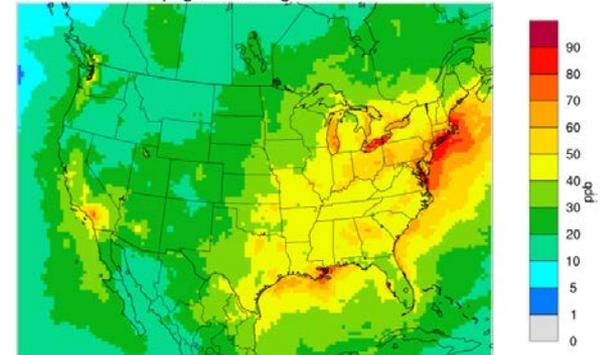
Max(82,2) = 80.37

Contrib. to CAMx Daily Max 8-Hour Ozone  $\geq 0$  ppb  
Natural 4th High Contribution



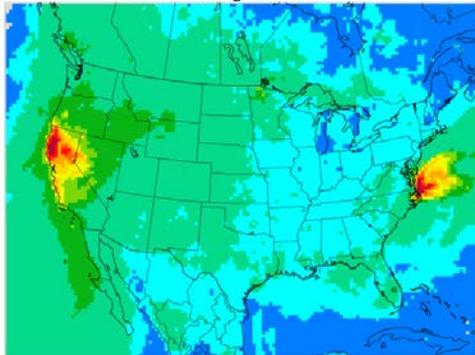
Max(70,11) = 12.84

Contrib. to CAMx Daily Max 8-Hour Ozone  $\geq 0$  ppb  
Anthropogenic 4th High Contribution



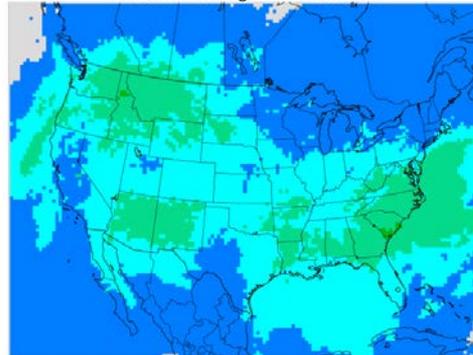
Max(133,70) = 110.89

Contrib. to CAMx Daily Max 8-Hour Ozone  $\geq 0$  ppb  
Wildfires 4th Highest Contribution



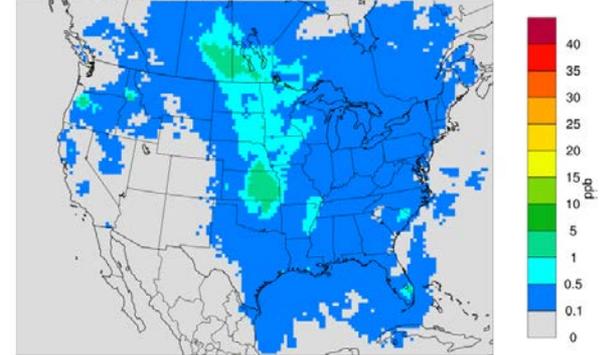
Max(129,53) = 60.13

Contrib. to CAMx Daily Max 8-Hour Ozone  $\geq 0$  ppb  
Rx Burns 4th Highest Contribution



Max(116,41) = 6.16

Contrib. to CAMx Daily Max 8-Hour Ozone  $\geq 0$  ppb  
Agricultural Burns 4th Highest Contribution



Max(79,51) = 3.15

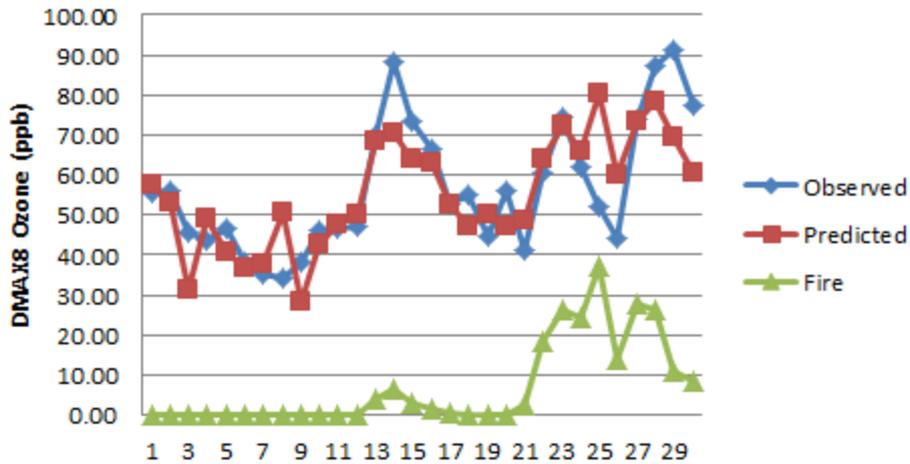
Wildfire

Prescribed Fire

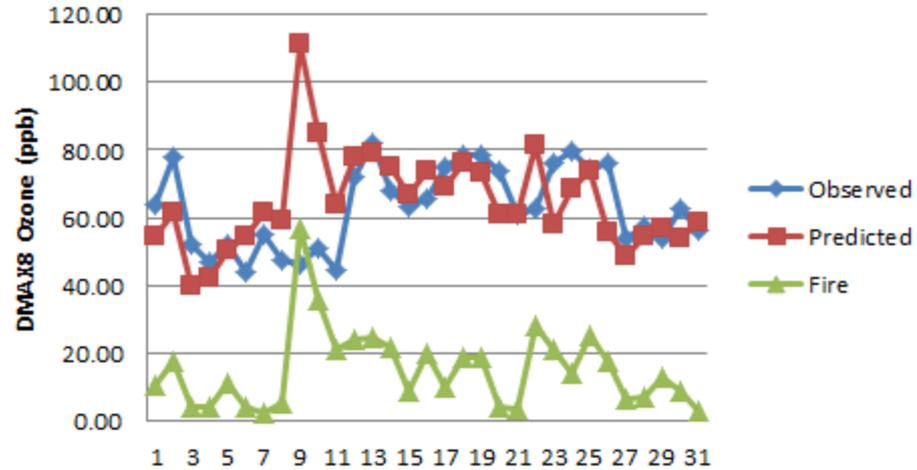
Agricultural Fire

# Northern California Wildfires June-July 2008

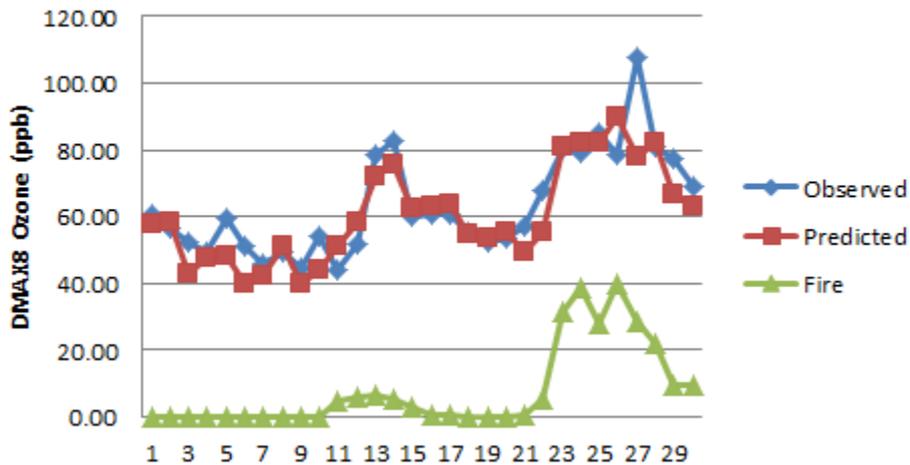
June Base08c DMAX8 Ozone Shasta 0007



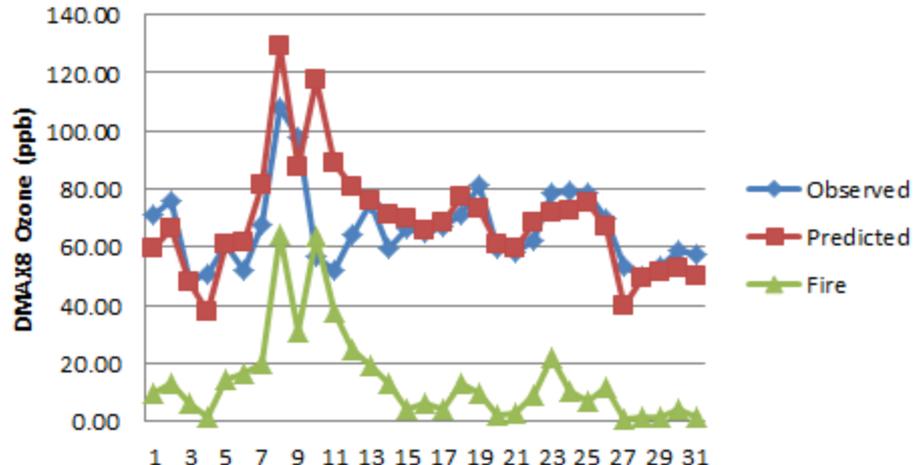
July Base08c DMAX8 Ozone Shasta 0007



June Base08c DMAX8 Ozone Butte 0007

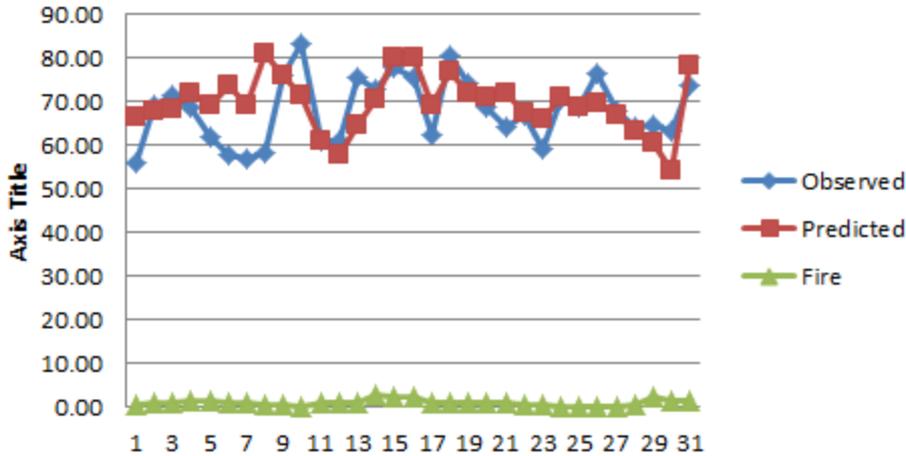


July Base08c DMAX8 Ozone Butte 0007

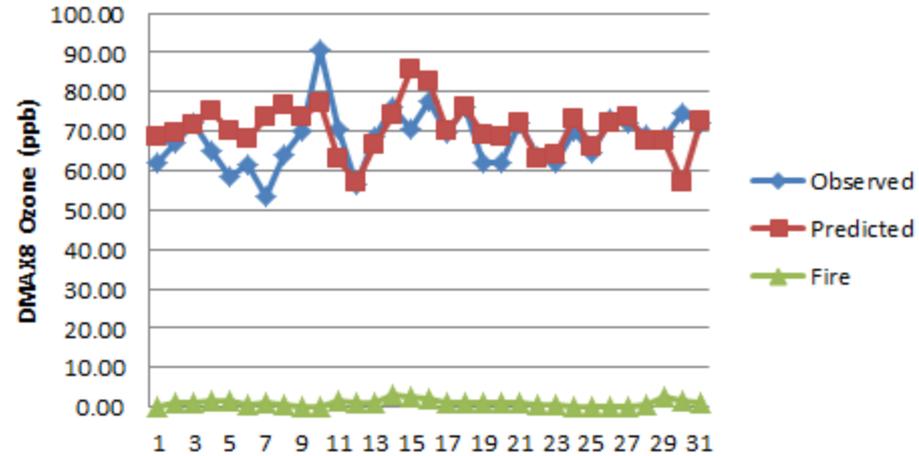


# Denver Ozone Monitors July 2008

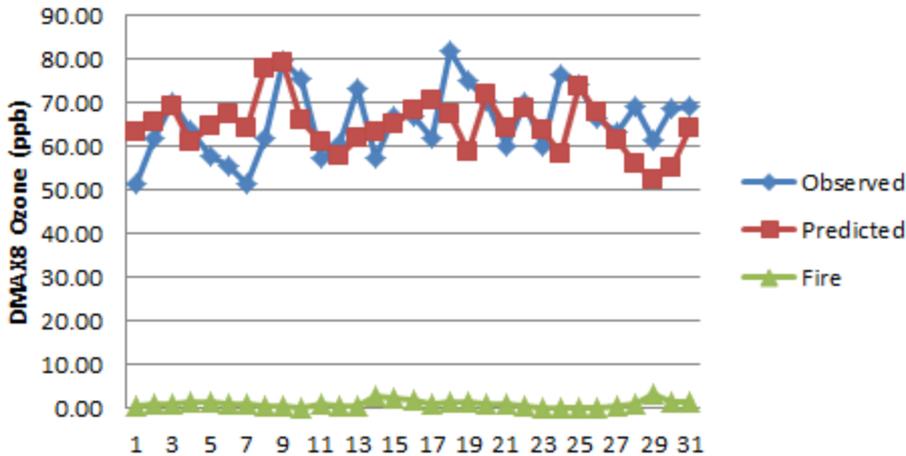
## Jul DMAX8 Ozone Rocky Flats No



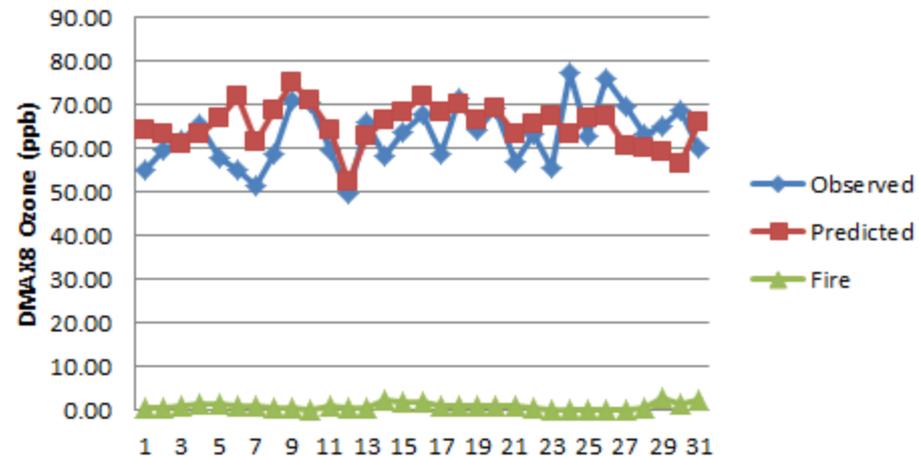
## Jul Base08c DMAX8 Ozone Chatfield



## Jul Base08c DMAX8 Fort Collins West



## Jul Base08c DMAX8 Greeley

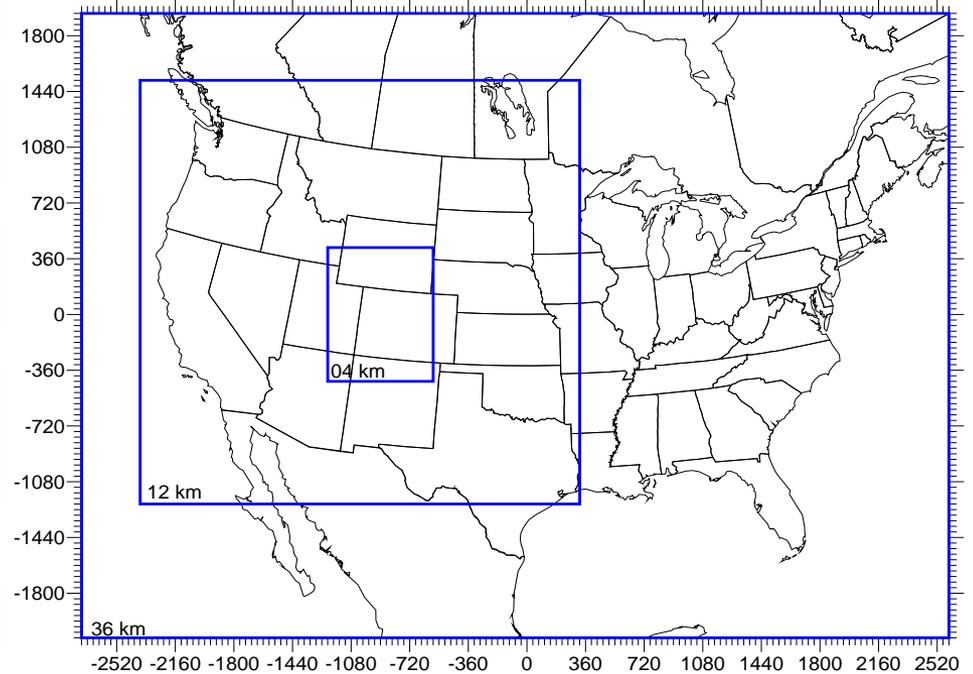
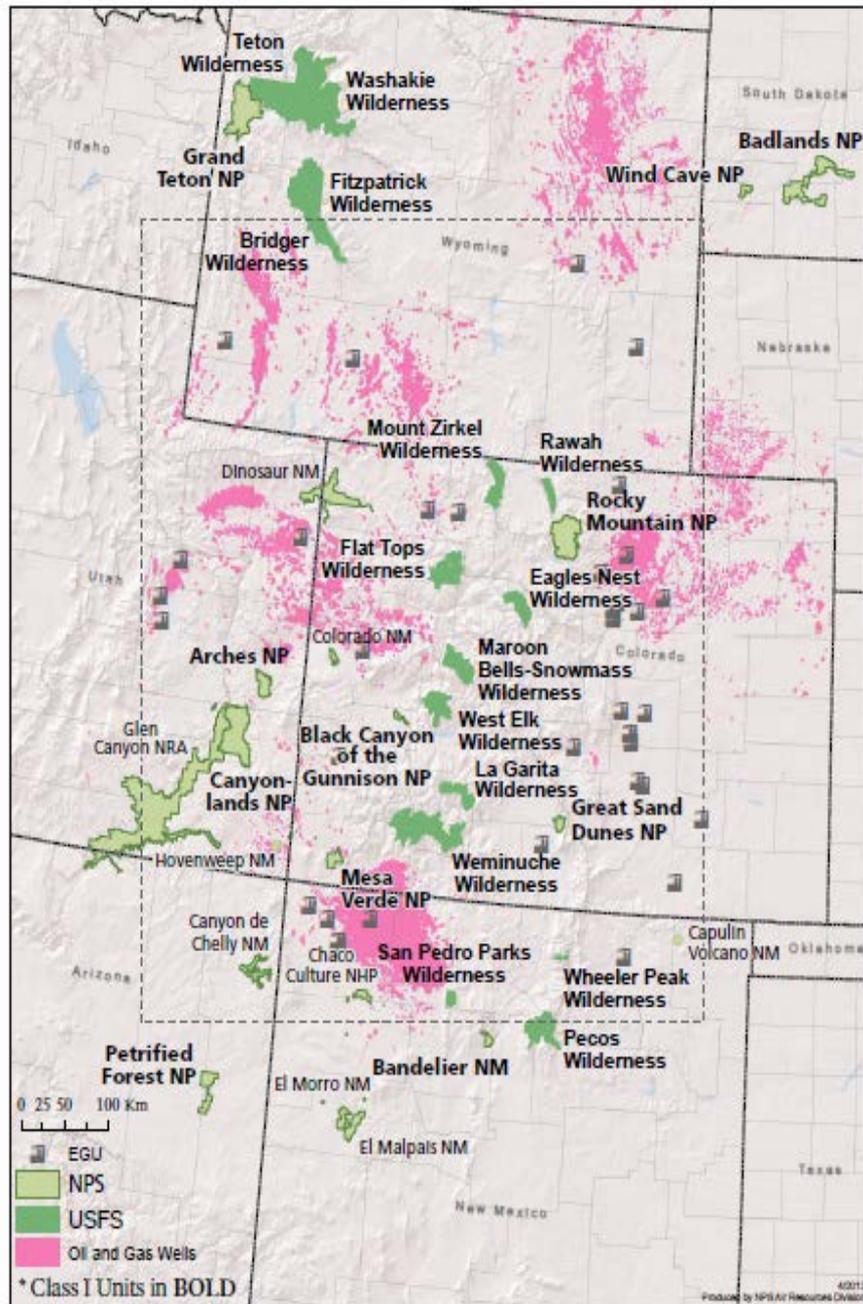


# Detailed Source Category-Specific Source Apportionment

- **Six Source Categories:**
  - Natural (Biogenic, Lightning, Sea Salt & WBD)
  - Fires (WF, Rx, & Ag)
  - Upstream Oil and Gas (O&G)
  - Point Sources (EGU & Non-EGU)
  - Mobile Sources (on-road, non-road & CMV)
  - Remainder (Area/Non-Point)
- **Ozone Apportionment**
  - May-Aug 2008
  - 36/12/4 km Domains
  - 4 States (CO, NM, UT & WY)

# Ozone Source Category-Specific Source Apportionment

← 4 km Detailed Source Apportionment Domain  
 36/12/4 km Two-Way Grid Nesting  
 (Results in Appendix I on WestJumpAQMS webpage)



**CAMx Modeling Domain**

36 km : 148 x 112 (-2736, -2088) to (2592, 1944)  
 12 km\* : 227 x 230 (-2388, -1236) to ( 336, 1524)  
 04 km\* : 164 x 218 (-1228, -436) to ( -572, 436)

\* includes buffer cells

# Summary of WestJumpAQMS 2008 Modeling Results for New Mexico

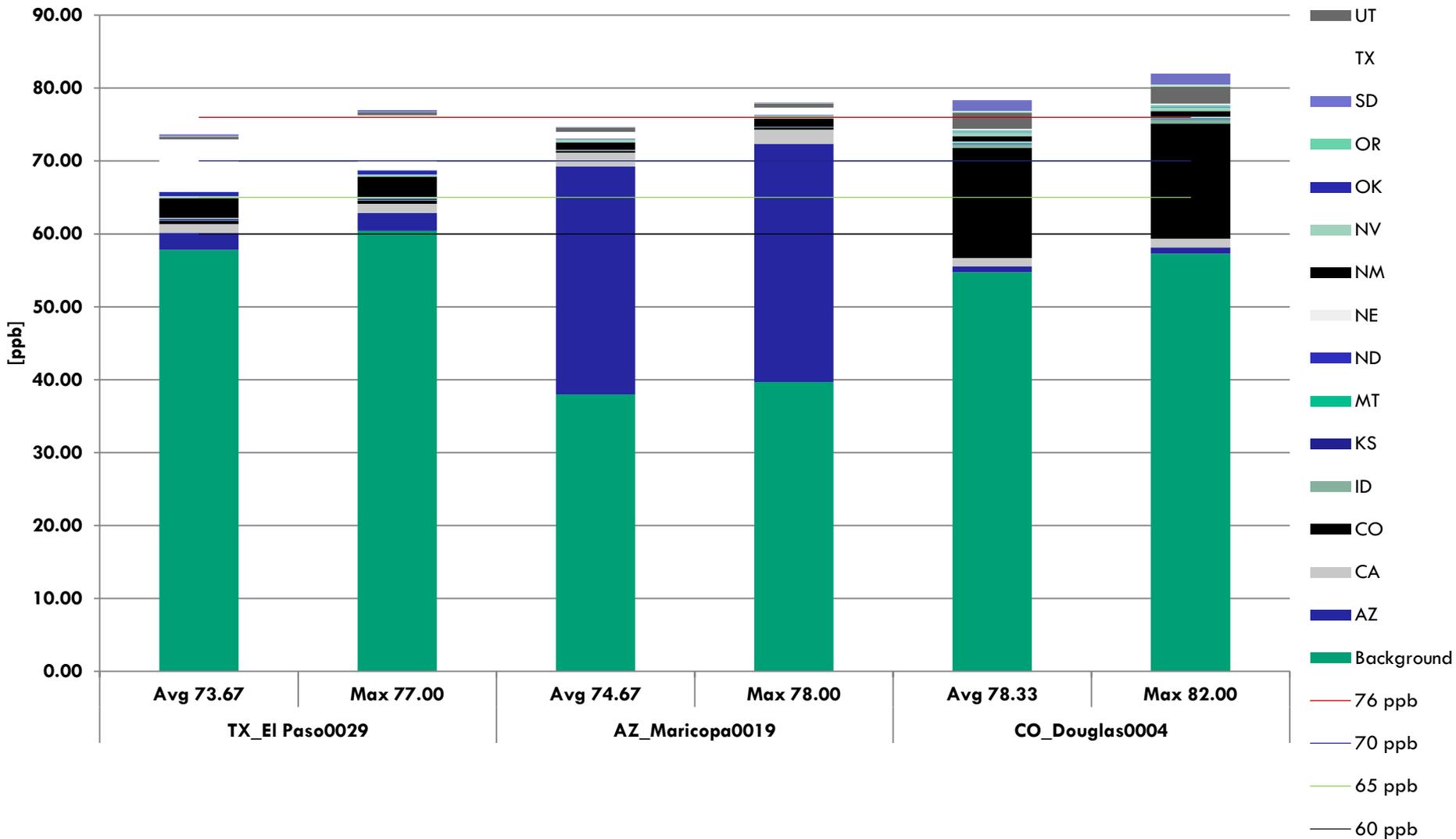
- Shown earlier
  - Examples of Upwind Ozone Contribution to highest, 4<sup>th</sup> highest, and 10<sup>th</sup> highest modeled days at 4 monitor sites measuring 70 ppb or higher (shown earlier, from Appendix B)
- Next
  - New Mexico's Ozone Contribution to Downwind States (from Appendix A)
  - Spatial distribution of total modeled daily 8-hour maximum ozone contribution and Colorado examples of contribution at 65 ppb NAAQS
  - Detailed 2008 Highest Modeled Contribution to Ozone (from Appendix I)

# New Mexico's Ozone Contribution to Downwind States

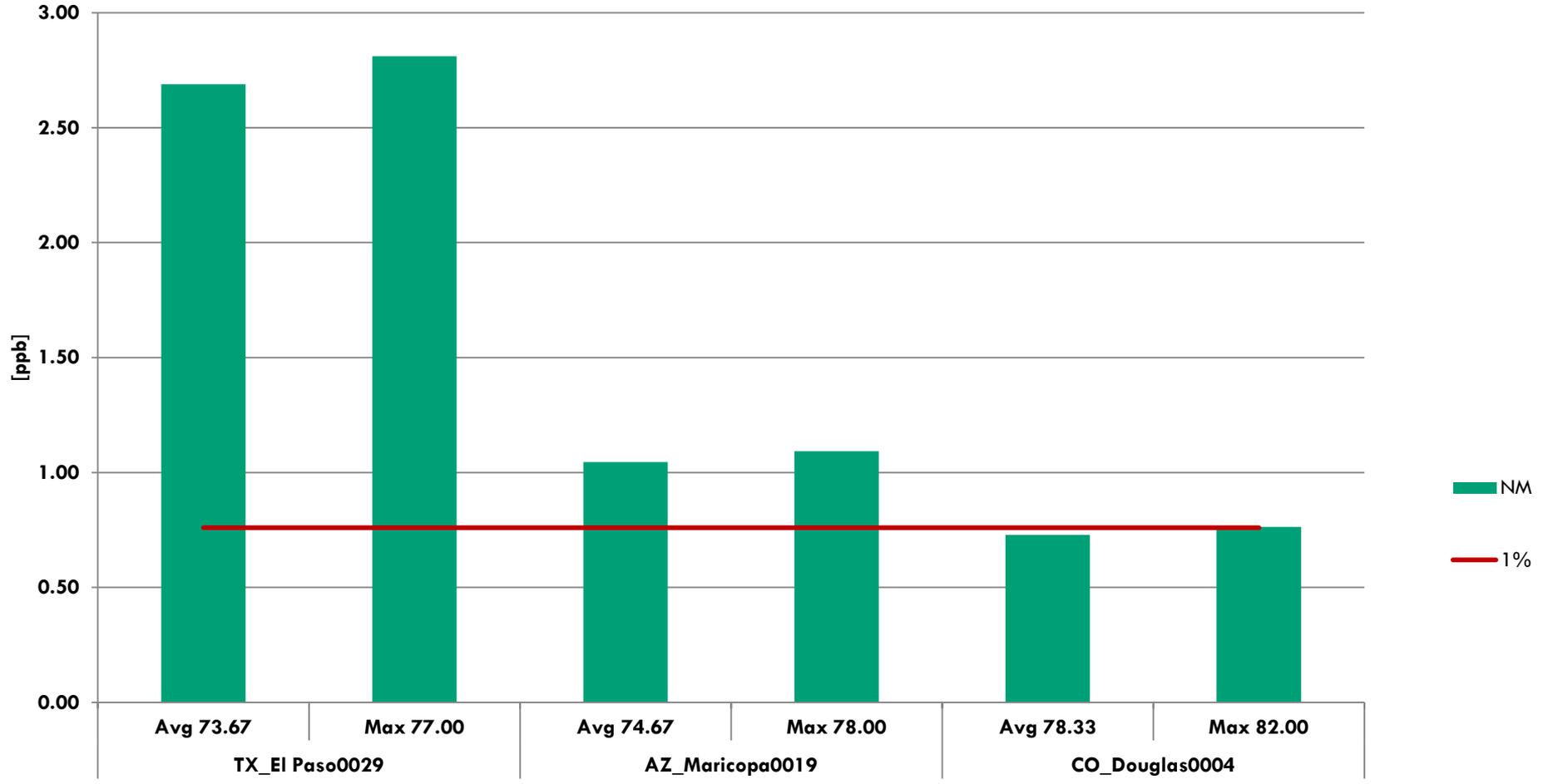
(from WestJumpAQMS Appendix A)

- A significant contribution for this analysis is 1% of the standard or contributions  $> 0.76$  ppb, addressing the current Ozone NAAQS
- At the current Ozone NAAQS level of 75 ppb, New Mexico significantly contributes to downwind nonattainment in surrounding States, AZ and TX
- If the Ozone NAAQS were lowered below 70 ppb or lower, then New Mexico would start to be a significant contributor to downwind exceedances, again in TX and AZ
- This analysis is for 2008 and is not a regulatory analysis that would have to examine a future year. A future year analysis, as is done for CSPAR, would be required in a Transport SIP.

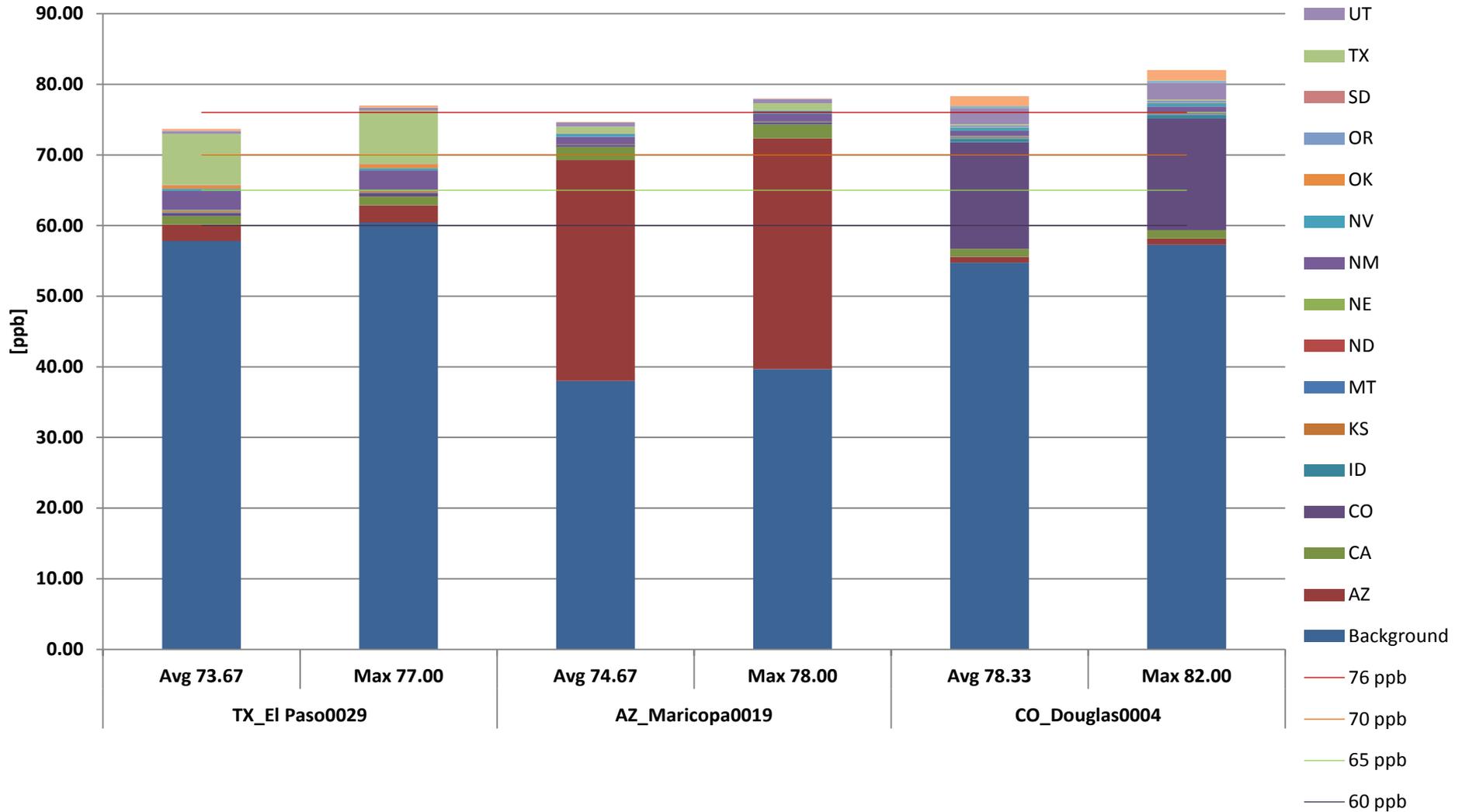
# States' Contributions to Top 5 States Surrounding New Mexico, where DV is at or above 76.0 ppb Threshold



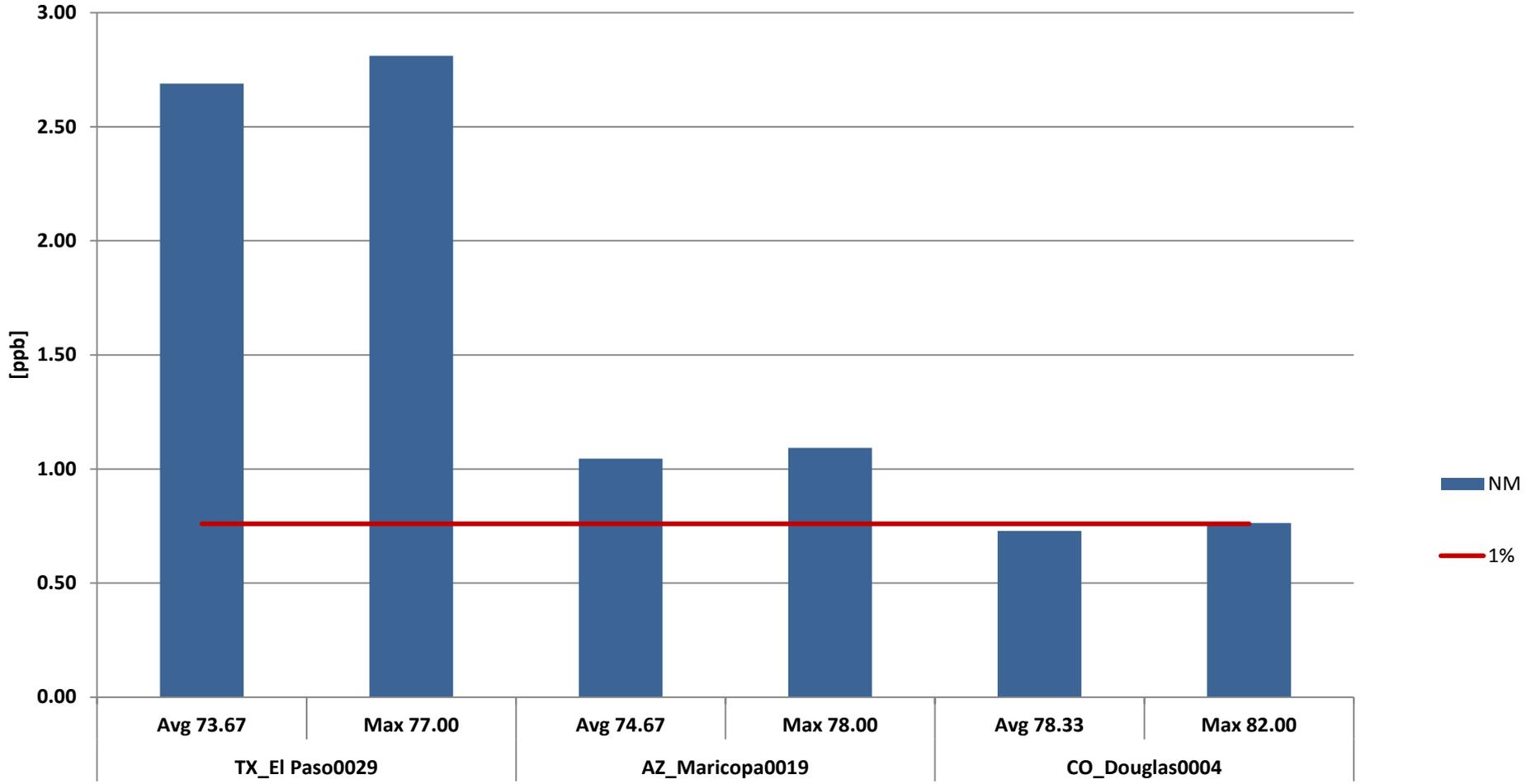
# New Mexico's Contributions to Top 5 States Surrounding New Mexico, where DV is at or above 76.0 ppb Threshold



# States' Contributions to Top 5 States Surrounding New Mexico, where DV is at or above 70.0 ppb Threshold



# New Mexico's Contributions to Top 5 States Surrounding New Mexico, where DV is at or above 70.0 ppb Threshold

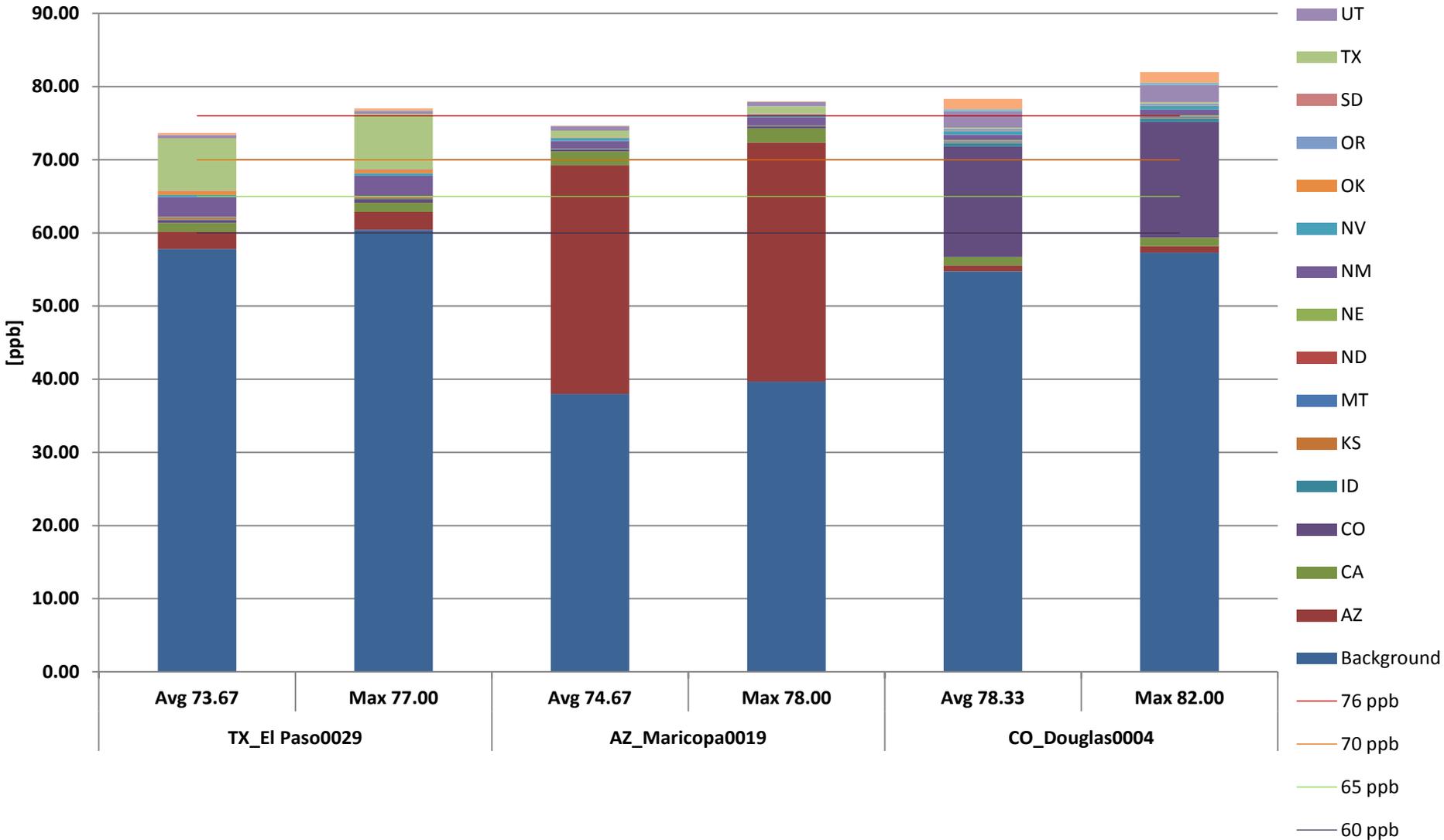


## New Mexico's Ozone Contribution to Downwind States, cont.

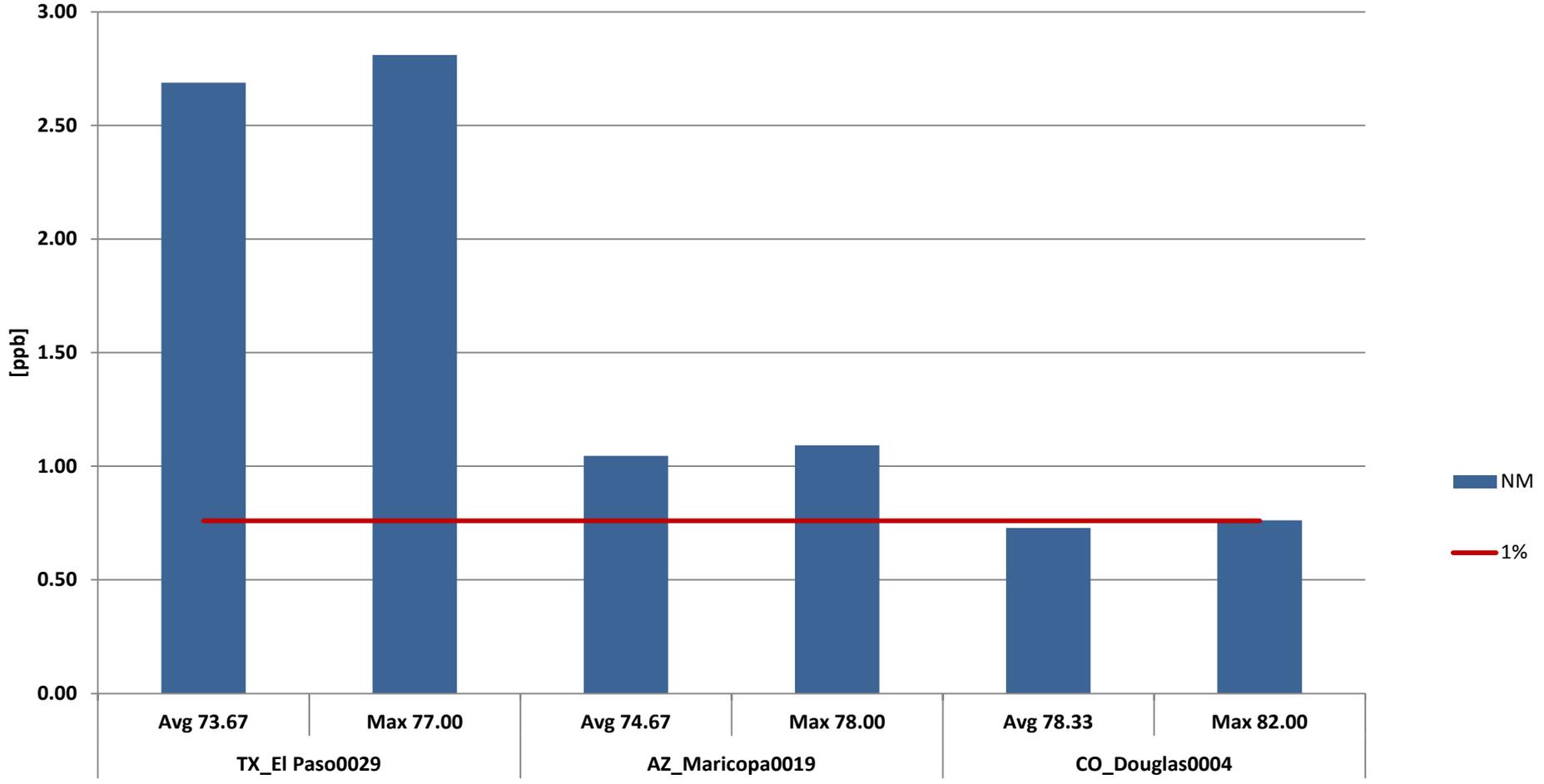
(from WestJumpAQMS Appendix A)

- If the Ozone NAAQS were lowered to 65 ppb then New Mexico would start to be a significant contributor ( $> 0.65$  ppb) to downwind exceedances especially in Montezuma County CO, Maricopa County AZ, and El Paso County, TX
- If the Ozone NAAQS were lowered to 60 ppb then New Mexico would continue to be a significant contributor ( $> 0.60$  ppb) to downwind exceedances in Montezuma County CO, Maricopa County AZ, and El Paso County, TX
- This analysis is for 2008 and is not a regulatory analysis that would have to examine a future year. A future year analysis, as is done for CSPAR, would be required in a Transport SIP.

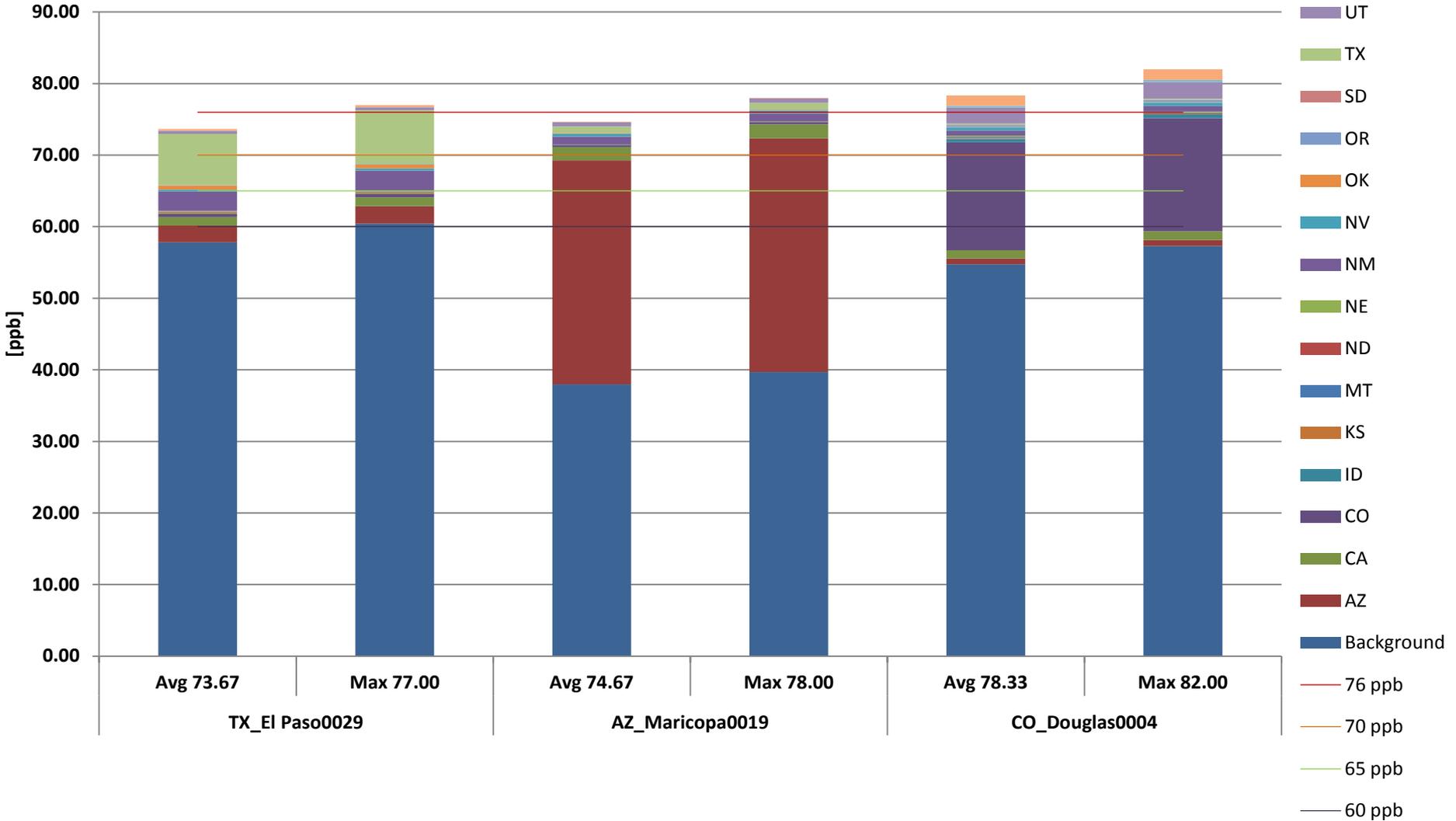
# States' Contributions to Top 5 States Surrounding New Mexico, where DV is at or above 65.0 ppb Threshold



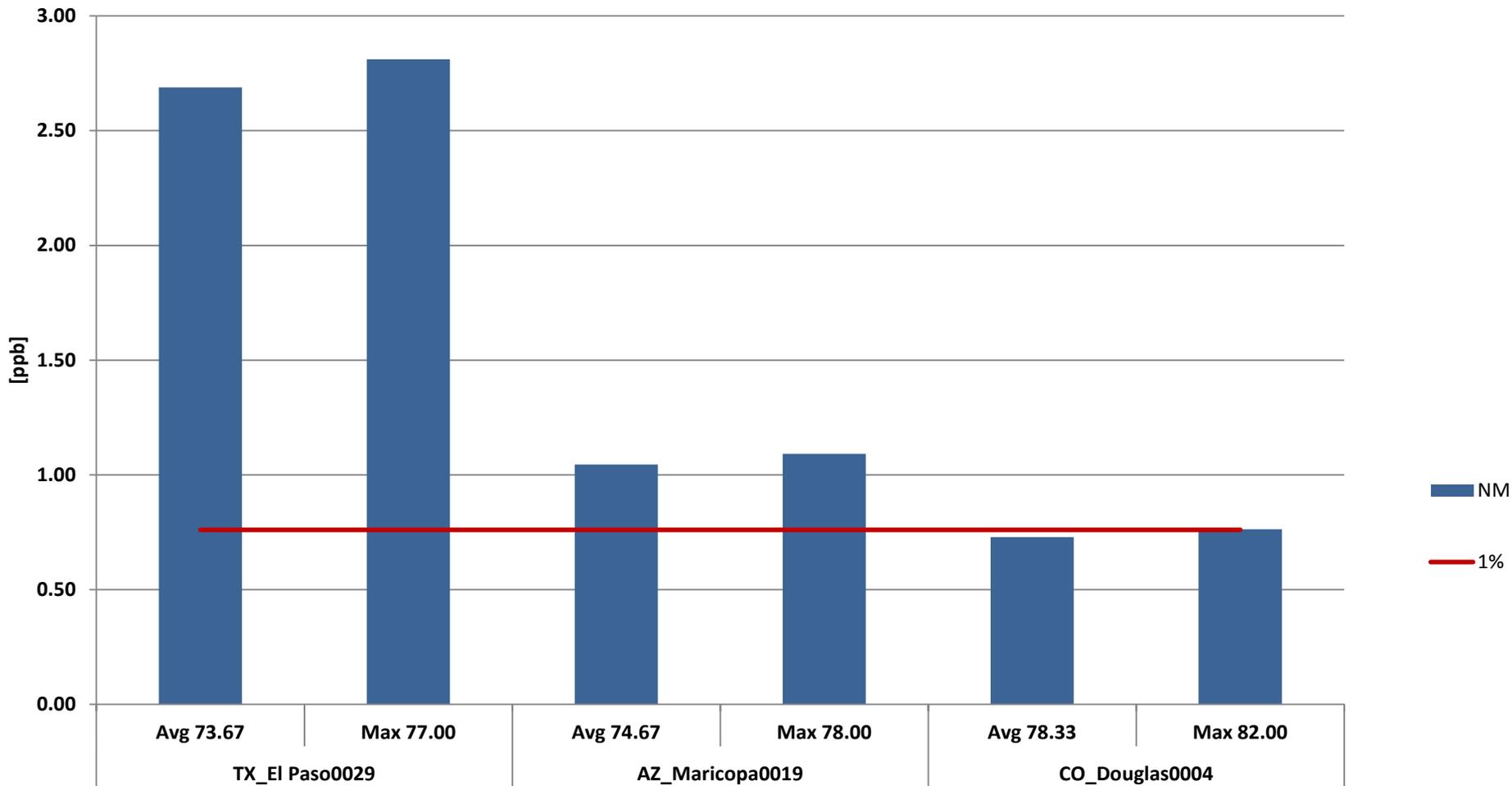
# New Mexico's Contributions to Top 5 States Surrounding New Mexico, where DV is at or above 65.0 ppb Threshold



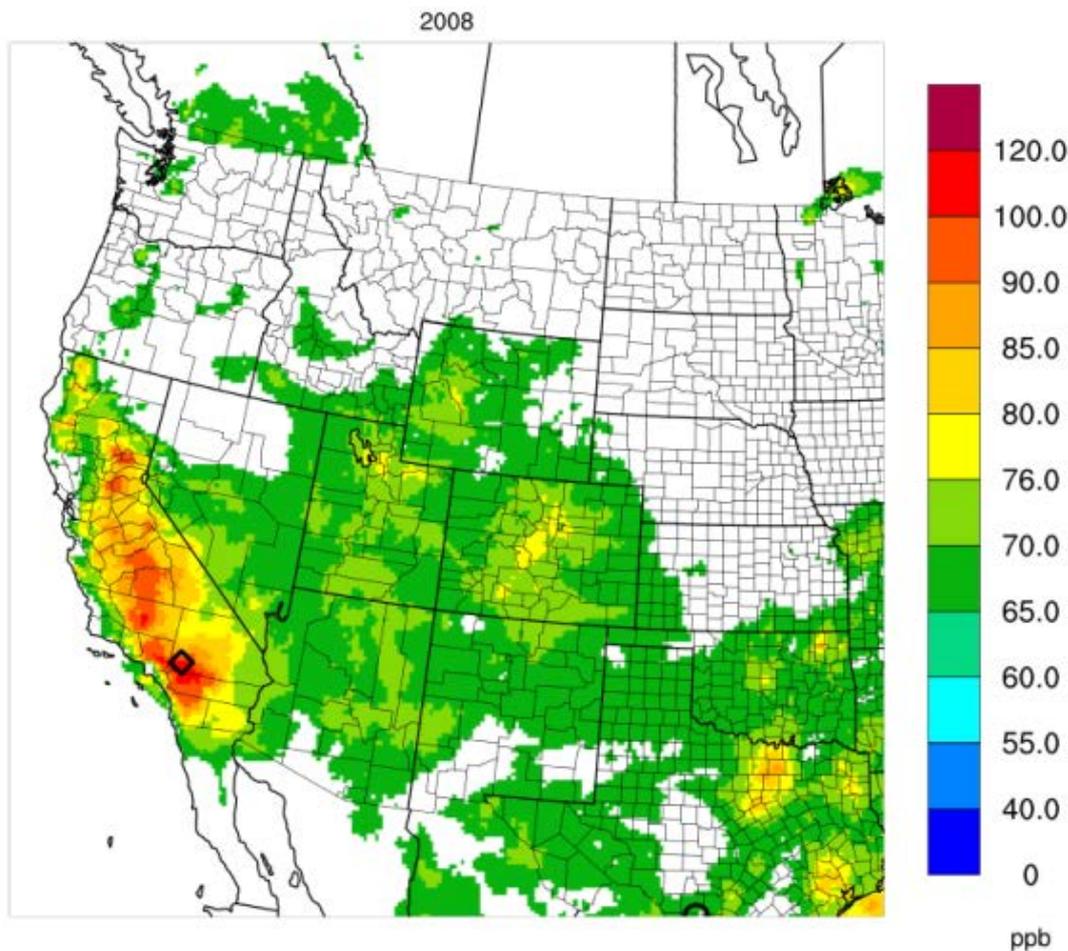
# States' Contributions to Top 5 States Surrounding New Mexico, where DV is at or above 60.0 ppb Threshold



# New Mexico's Contributions to Top 5 States Surrounding New Mexico, where DV is at or above 60.0 ppb Threshold



# Spatial Distribution of the Maximum Modeled 2008 Anthropogenic contribution at a 65 ppb level for the Ozone NAAQS (from WestJumpAQMS Appendix C)

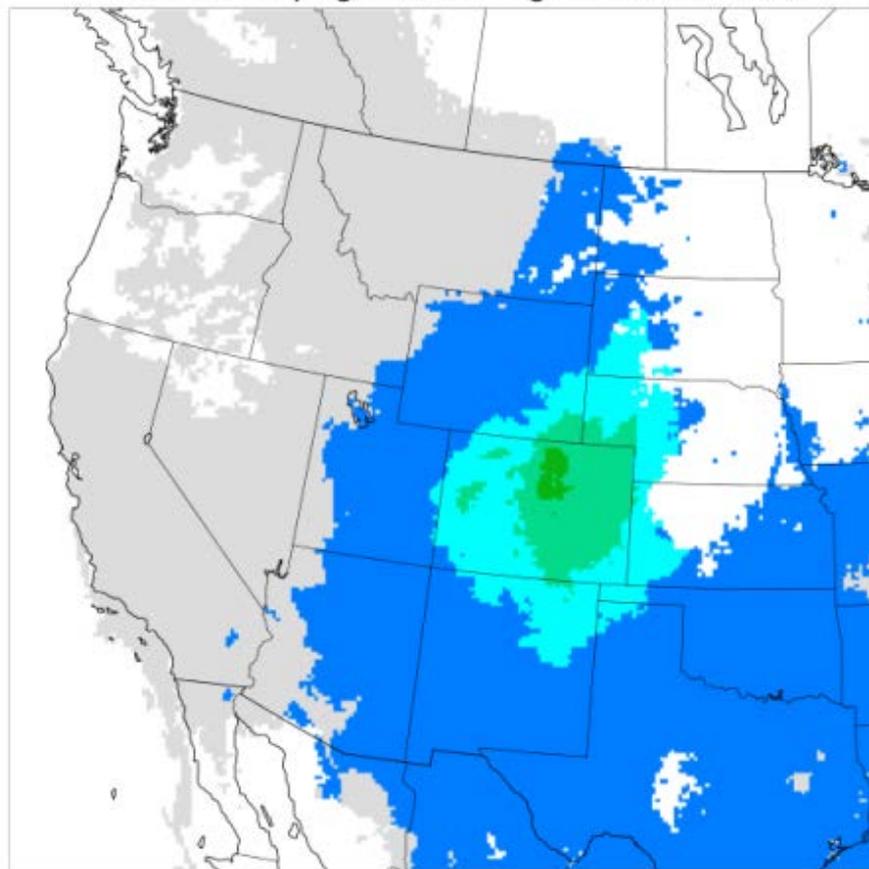


○ Min(177,1) = 65.00, ◇ Max(45,67) = 113.30

- If the Ozone NAAQS is lowered to 65 ppb then New Mexico and portions of a number of other western states would be modeled as nonattainment areas.

# Example Spatial Distribution of the Maximum Modeled 2008 Colorado Anthropogenic contribution at a 65 ppb level for the Ozone NAAQS (from WestJumpAQMS Appendix C)

**Contrib. to CAMx Daily Max 8-Hour Ozone  $\geq$  65 ppb**  
CO Anthropogenic 4th Highest Contribution

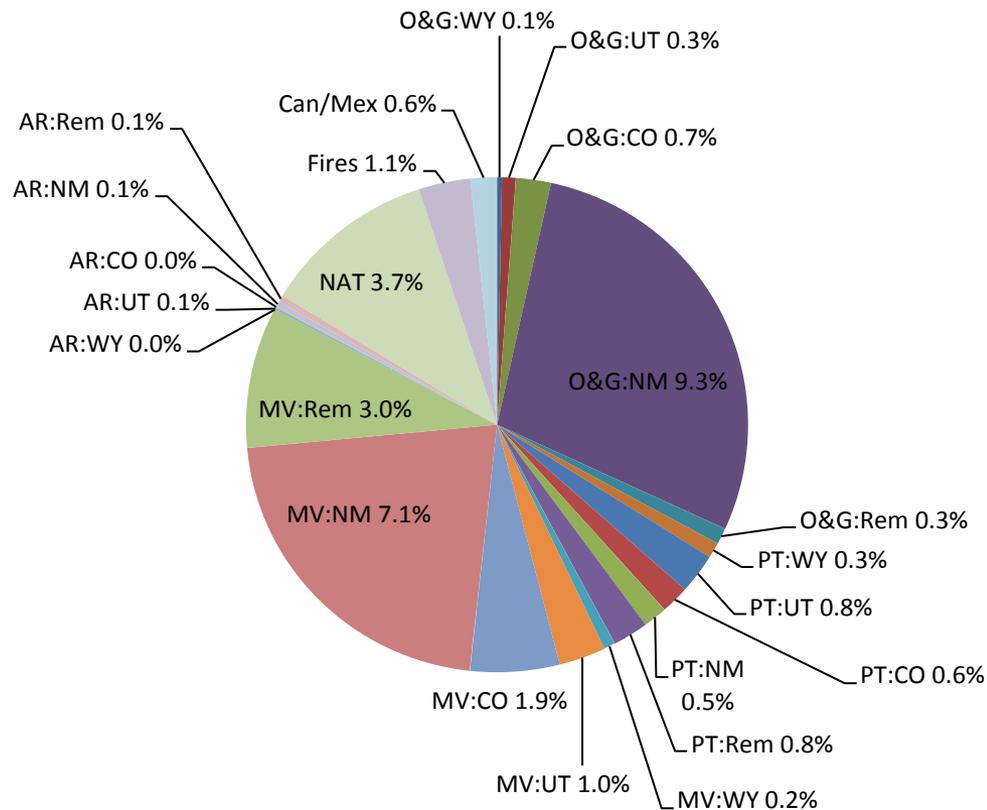


Max(142,109) = 24.25

- From previous slides Colorado would have a significant contribution ( $> 0.65$  ppb) to non-attainment at the San Juan County monitor in northwestern New Mexico, as well as monitors in Oklahoma, Texas, and Kansas.

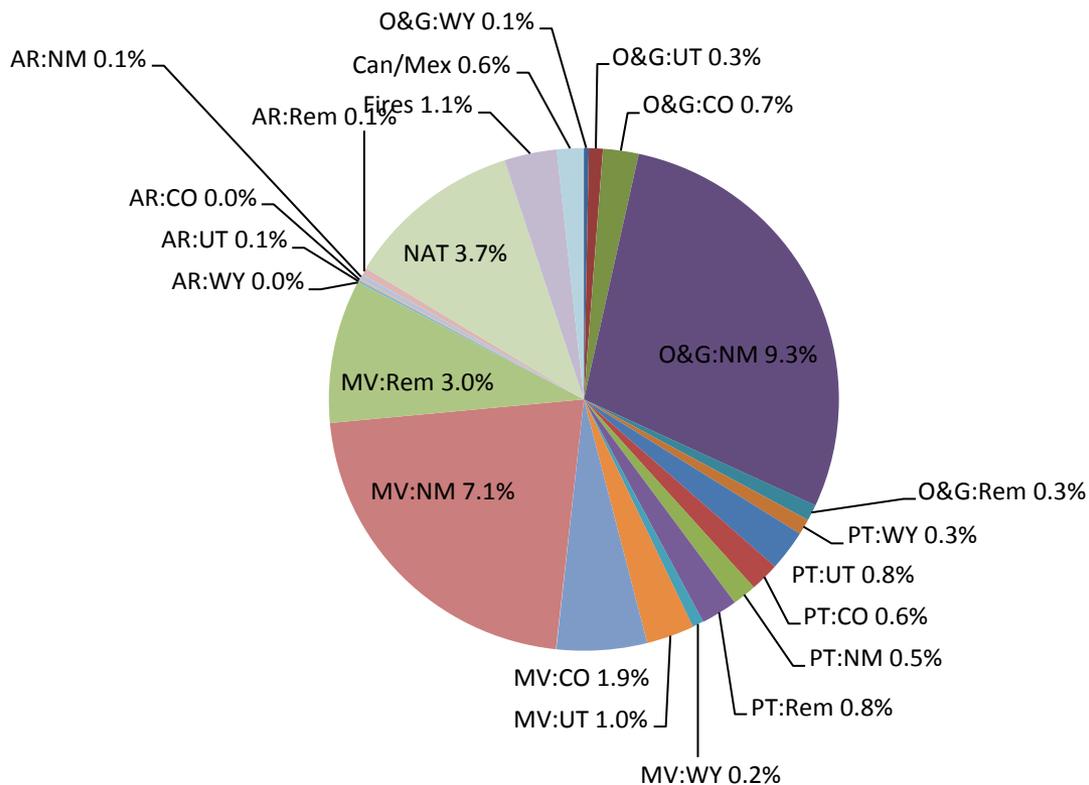
# Detailed 2008 Highest Modeled Contribution to Ozone at Navajo Lake, NM (from WestJumpAQMS Appendix I)

**Contributions to MDA8 Ozone [ppb] at NM\_San Juan0018**  
Rank (1) 06/13/08; Model = 79.8 ppb; Obs = 77.6 ppb; Bias = +2.9%; BC = 69.0 ppb (86.4%)



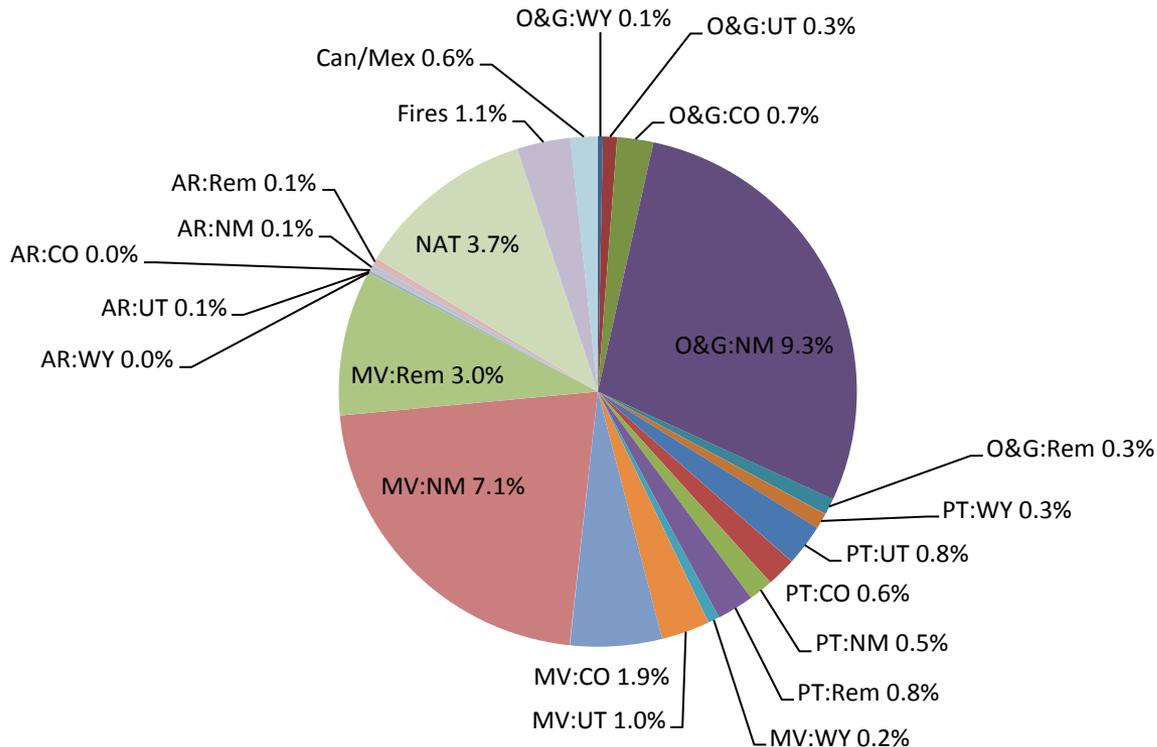
# Detailed 2008 4<sup>th</sup> Highest Modeled Contribution to Ozone at Navajo Lake, NM (from WestJumpAQMS Appendix I)

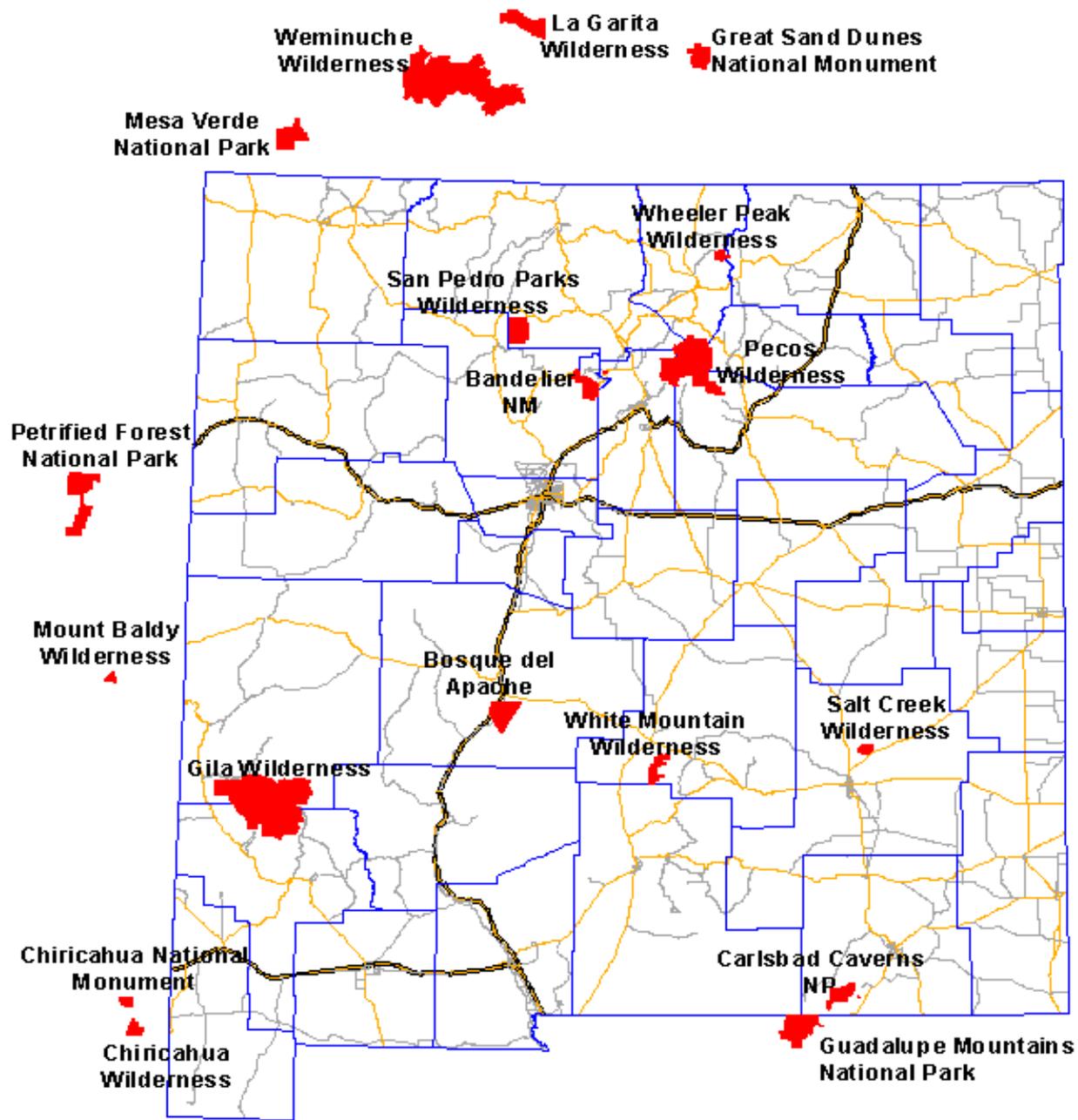
**Contributions to MDA8 Ozone [ppb] at NM\_San Juan0018**  
**Rank (4) 05/02/08; Model = 71.2 ppb; Obs = 61.6 ppb; Bias = +15.5%; BC = 59.7 ppb (83.8%)**



# Detailed 2008 10<sup>th</sup> Highest Modeled Contribution to Ozone at Navajo Lake, NM (from WestJumpAQMS Appendix I)

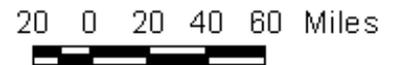
**Contributions to MDA8 Ozone [ppb] at NM\_San Juan0018**  
**Rank (10) 07/04/08; Model = 68.9 ppb; Obs = 64.5 ppb; Bias = +6.9%; BC = 46.4 ppb (67.3%)**





### Class I Areas within 100 kilometers of New Mexico

- Class I Areas
- County Lines
- Roads
  - Interstate highways
  - Primary road
  - Secondary and connecting road



# PM and Visibility Source Apportionment Resources from WestJumpAQMS

- Appendices A through I address Ozone
- Appendix J: Source Category-Specific Contributions to Annual PM<sub>2.5</sub> Design Values at Monitoring Sites in the 12 km WESTUS Domain using MATS ([XLSX](#) 2MB)
- Appendix K: Source Category-Specific Contributions to Modeled Annual PM<sub>2.5</sub> Concentrations ( $\mu\text{g}/\text{m}^3$ ) at Monitoring Sites in the 12 km WESTUS Domain ([XLSX](#) 4MB)
- Appendix L: Source Category-Specific Contributions to 24-Hour PM<sub>2.5</sub> Design Values at Monitoring Sites in the 12 km WESTUS Domain using MATS ([XLSX](#) 2MB)
- Appendix M: Source Category-Specific Contributions to Ten Highest Modeled 24-Hour PM<sub>2.5</sub> Concentrations ( $\mu\text{g}/\text{m}^3$ ) at Monitoring Sites in the 12 km WESTUS Domain ([XLSX](#) 10MB)
- Appendix N: Annual Sulfur and Nitrogen Wet and Dry Deposition at IMPROVE Monitors by Species ([XLSX](#) 1MB)
- Appendix O: Western State-Specific Modeled Contributions to Visibility Impairment at IMPROVE Monitoring Sites for Modeled Worst (W20) and Best (B20) 20% Days during 2008 ([ZIP](#) 46MB)

## WestJumpAQMS Benefited From

- WRAP Regional Modeling Center (2002 Platform)
- Four Corners Air Quality Task Force (2005 Platform)
- Continental Divide-Creston EIS (2005/2006 Platform)
  - NEPA O&G EIS using PGM for far-field AQ/AQRV
- Denver Ozone SIP Modeling and Follow-On
- 2008 National Emissions Inventory (2008 NEIv2.0)
  - Cornerstone to 2008 emissions
- WRAP Phase III O&G Emissions Study
  - Projected to 2008 plus add Permian Basin
- WESTAR-funded MEGAN Biogenic Emissions Enhancement Study
- DEASCO<sub>3</sub> 2008 Fire Emissions

## Benefited from WestJumpAQMS

- Colorado Air Resource Management Study (CARMMS)
  - 2008 4 km Modeling Platform
- Deterministic & Empirical Assessment of Smoke's Contribution to Ozone (DEASCO<sub>3</sub>)
  - 2008 36/12 km Modeling Platform
- PMDETAIL -- Smoke contributions to PM
- Three-State Data Warehouse (3SDW) and Three-State Air Quality Study (3SAQS)
  - 2008 36/12/4 km Modeling Platform; Test database for 3SDW
- Additional Follow-On Studies
  - NPS, BLM, etc.

Thanks –

Tom Moore, WRAP Air Quality Program Manager  
Western States Air Resources Council (WESTAR)

e: [tmoore@westar.org](mailto:tmoore@westar.org) | o: 970.491.8837

Western Regional Air Partnership | [www.wrapair2.org](http://www.wrapair2.org)