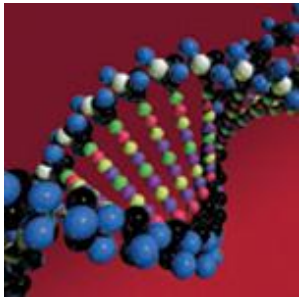
WestJumpAQMS Final Progress Report – Source Category-Specific Source Apportionment and Final Report



ENVIRON International Corporation
Alpine Geophysics, LLC
UNC Institute for the Environment

August 29, 2013

WESTERN REGIONAL AIR PARTNERSHIP

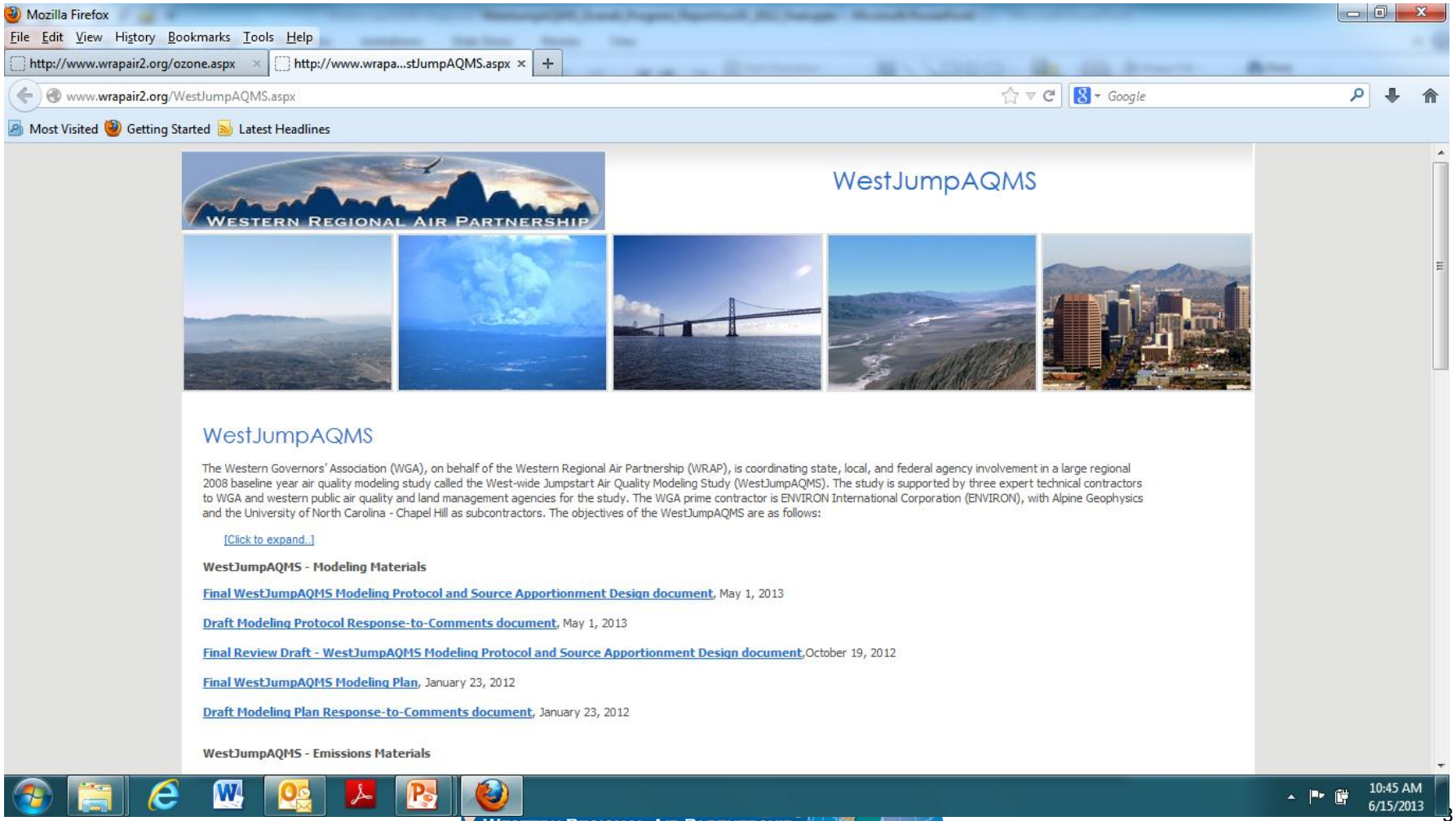
ENVIRON

Background

- Future Ozone standards could result in many areas in western U.S. being nonattainment
- Western Regional Air Partnership (WRAP) has initiated the West-wide Jump Start Air Quality Modeling Study (WestJumpAQMS) to:
  - Initiate next generation of regional technical analysis for ozone planning in the western U.S.
  - Continue work conducted at the WRAP Regional Modeling Center (RMC) and leverage recent air modeling studies
  - Provide a preliminary assessment of the role of ozone transport to elevated ozone concentrations across the West

Background

- Contracting team of ENVIRON, Alpine Geophysics and UNC IE
- WestJumpAQMS Website with products to date



June 20, 2013 Progress Report Webinar

- WRF 2008 36/12/4 km Application/Evaluation
- 2008 Oil and Gas Emissions Update WRAP Phase III and Permian Basins
- 16 Emissions Summary Memorandums
- SMOKE Emissions Modeling for 2008 36/12/4 km domains
- CAMx Model Input Development
  - MOZART BCs
- Calculate Basin-wide WRAP Phase III O&G EFs for use in 2011 NEI
- CAMx 2008 36/12 km Base Case
  - Model Performance Evaluation
- CAMx 2008 36/12 km State-Specific Ozone Source Apportionment
  - CSAPR-type analysis of upwind state's contributions to Design Values using MATS
  - State ozone footprint maps
    - Modeled 1stmax and 8thmax to ozone ≥ 76, 70, 65, 60 and 0 ppb

July 26, 2013 Progress Report Webinar

- 2008 36/12 km State-Specific Ozone Source Apportionment
  - Refined Results
  - Interactive Spread Sheets to drill down into results at each monitor
    - MATS DVs and 10 High Modeled Days
- North American Background (NAB) Ozone
  - w/ and w/o Wildfires
- 2008 36 km State-Specific PM Source Apportionment
  - CSAPR-Type State-Specific DV Contributions
    - Annual
    - 24-Hour
  - PM2.5 Footprint Maps
- MOZART vs. GEOS-Chem BC Sensitivity Test
  - Model Performance
  - Stratospheric Ozone

Today's August 29, 2013 Progress Report

- Source Category-Specific Source Apportionment
  - Ozone 36/12/4 km DSAD
  - PM 36/12
  - Modeled and MATS DV
    - Six USA Source Categories: Natural, Fires, Oil and Gas, Point , Mobile, Area
    - Can/Mex/Offshore Marine
    - Boundary Conditions (BC)
    - Unexplained (for PM DVs using MATS)
- Colorado Air Resource Management Modeling Study (CARMMS) 4 km IAD Database
  - Base Case Simulation
  - Model Evaluation
- Final Report
  - Outline
  - 15 Interactive Appendices
- Next Steps
  - Review Final Report
  - 3SDW & 3SAQS

Final Report Outline

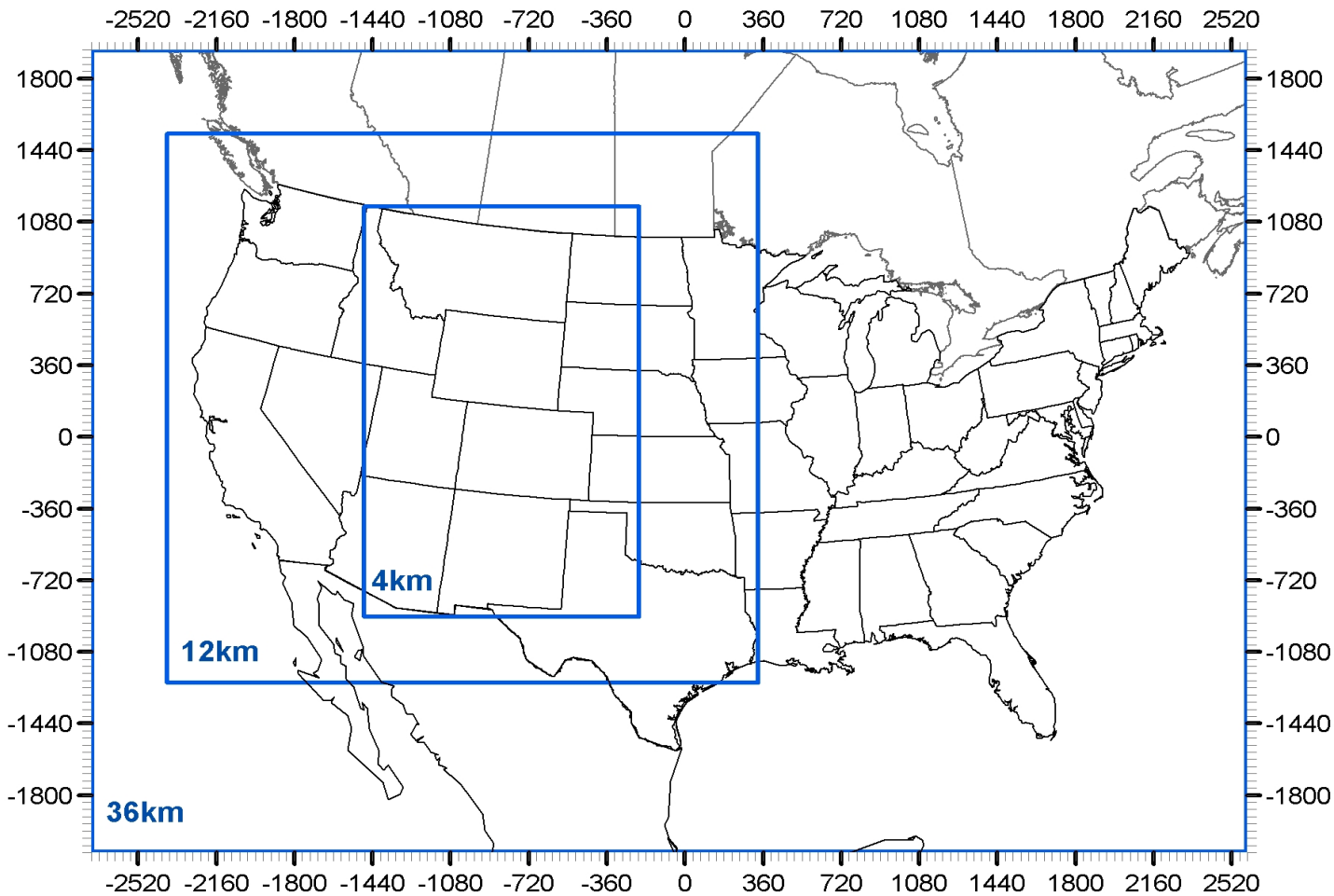
1. Introduction
2. Meteorological Modeling
3. 2008 Base Case Emissions
4. 2008 Base Case Modeling/Model Evaluation
5. 2008 State-Specific Ozone Source Apportionment
6. 2008 State-Specific PM Source Apportionment
7. 2008 Source Category-Specific Source Apportionment
8. Lessons Learned
9. References

- 15 Electronic Appendices

15 Electronic Appendices (A through O)

- Allows users to drill down into source apportionment analyzing data at individual monitors and for high days as well as look at effects of alternative ozone NAAQS levels
  - Absolute modeled results
  - Contributions to Design Values using MATS
- Data in Excel spreadsheets with pivot tables that can be downloaded from WRAP website
  - Select monitoring sites, species, source categories and days to display results
- Spatial map displays in zipped files
- Will highlight these Appendices during this presentation

36 km CONUS; 12 km WESTUS & 4 km IMWD processing domain



Modeling Domain

Summary of CAMx 2008 36/12 km Inputs

- WRF 2008 36/12 km Meteorology
- MOZART Global Model Boundary Conditions
- 2008 Base Case Emissions
  - WRAP Phase III 2008 Oil and Gas Emissions
    - 2008 NEI O&G outside of WRAP Basins
  - MEGAN Biogenic Emissions
  - Hourly CEM for Electrical Generating Units (EGUs)
  - 2008 National Emissions Inventory (NEIv2)
  - Fire INventory from NCAR (FINN) [Base08a&b]
  - DEASCO3 Fire Emissions (Base08c)

CAMx 2008 36/12 km Base Cases

- Base08a – FINN Fires -- May, Jun and Jul 2008
- Base08b – FINN Fires – 2008 36/12 km Annual
  - Correct double counting of SUIT O&G emissions (Southwest CO) from WRAP and 2008 NEI
- Base08c – DEASCO3 Fires (WF, Rx & Ag) – 2008 36/12 km Annual
  - Correct O&G county swapping
  - Model performance evaluation
    - ozone, $PM_{2.5}$ and speciated $PM_{2.5}$ (SO4, NO3, NH4, EC, OA, Soil and OPM2.5)
    - 36 km CONUS and 12 km WESTUS domains and by western state

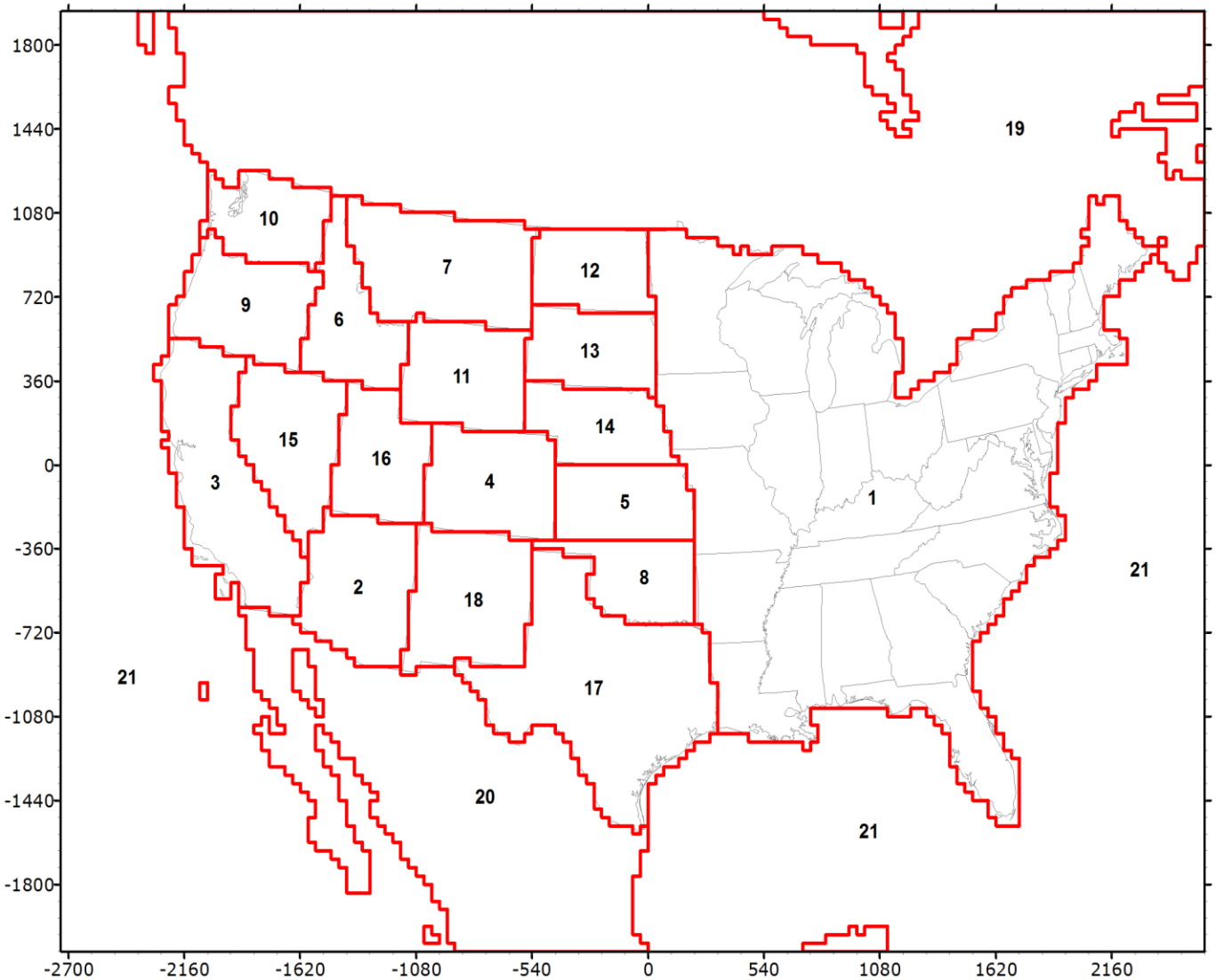
Summary Base08c CAMx PM Performance

- Daily maximum 8-hour ozone performance mostly good
  - Some overestimation bias, but within Performance Goals
- Operational difference in speciated PM species definitions in modeling vs. monitoring
  - For example, Other $PM_{2.5}$ (OPM2.5) overestimation
- In general fairly good model performance for $PM_{2.5}$, SO_4, NH_4 and EC
- NO3 underestimation in summer
  - Summer NO_3 concentrations very low, better NO_3 performance in winter when NO3 concentrations higher
- OA is underestimated, especially in summer
  - Missing emissions (SVOC) and Measurement uncertainties (SANDWICH)

State-Specific Source Apportionment Modeling

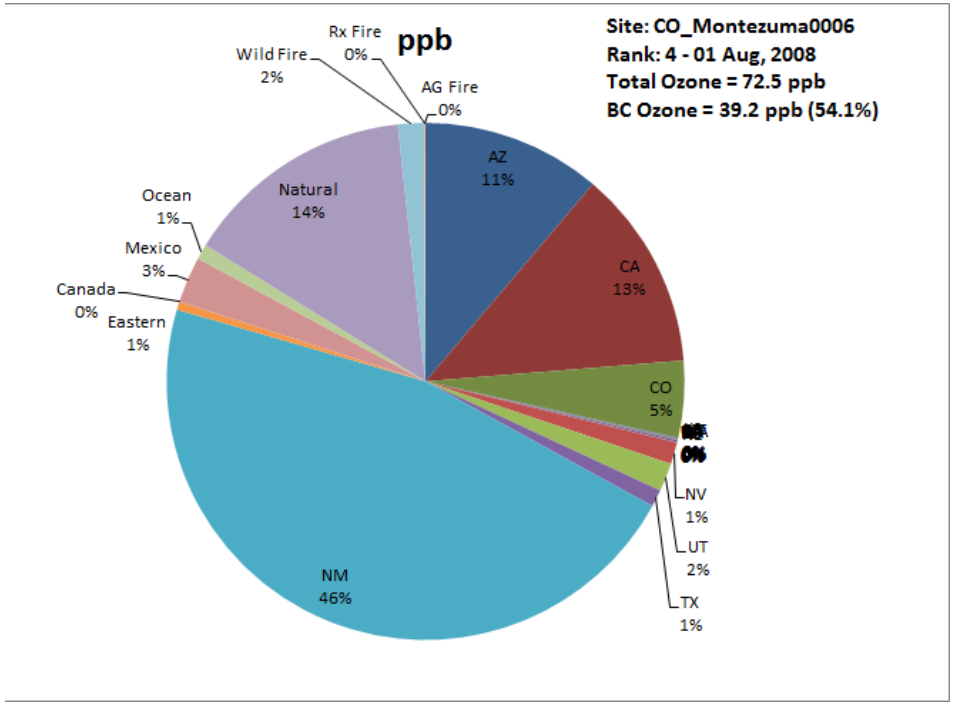
- 2008 Base Case emissions scenario
- Source Regions (21): 17 Western States, EUSA, Can, Mex & Offshore
- Source Categories (5): Natural (Biogenic, Lightning, Sea Salt and WBD), Fire (separately for WF, Rx, AG) and Anthropogenic
- Source Groups (107): 21 x 5 + 2 (for IC and BC)
  - For each Source Group track ozone formation using four reactive tracers (N, V, O3N & O3V)
  - Use APCA version of ozone source apportionment
- CSAPR-type transport analysis
  - Examine upwind state anthropogenic (Anthro+Rx+Ag) contribution to downwind state ozone/$PM_{2.5}$ Design Values
- Spatial extent of state contributions to high ozone (1st and 4th Highest DMAX8) and $PM_{2.5}$ (8th Highest 24-Hour)
  - Ozone contribution to DMAX8 ozone ≥ 76, 70, 65, 60 and 0 ppb
  - $PM_{2.5}$ Contribution to 24-Hour $PM_{2.5}$ ≥ 35, 30, 25, 20 and 0 µg/m^3

State-Specific Source Apportionment
21 Source Regions



Ozone/PM Source Apportionment Displayed 2 Ways

- Absolute modeling results
  - Process raw source apportionment
  - For example, pie charts of state contributions on 10 highest modeled DMAX8 ozone days



- Use MATS to get contributions to current year Design Values (DVC)
  - Subtract Source Group (SG) source apportionment from 2008 Base Case for a Source Group (No_SG)
  - Run MATS using 2008 base case and No_SG modeling results to get projected DV with no Source Group (DVC_No_SG)
  - SG contribution to DVC is the difference (DVC – DVC_No_SSG)
  - Do this for all SGs to develop contribution to total DVC

Modeled Attainment Test Software (MATS)

- Typically feed current and future modeling results and current year Design Values (DVCs) to MATS and it uses model in relative sense (RRFs) to project future year Design Value (DVF = DVC x RRF)
- When doing this with Source Apportionment modeling results, found that the sum of all Source Group (SG) contributions does not equal the total DVC
  - Difference in total DVC and sum of all SG MATS DVC contributions is called "Unexplained"
  - For ozone DVCs, Unexplained is small (maybe round-off)
  - For $PM_{2.5}$ DVCs, Unexplained can be large
  - Believed to be partly due to numerical calculations in MATS (O_3 and $PM_{2.5}$)
  - For $PM_{2.5}$ also due to missing PM species not in source apportionment modeling (e.g., SOA, Sea Salt, Blank Correction, etc.)
  - For 24-Hour $PM_{2.5}$, have added complication of reordering of days to get 98th percentile for DVF

CSAPR-type Ozone Contribution Analysis

- State-Specific Anthropogenic (Anthro+Rx+Ag) contributions to 8-hour ozone Design Value (DVCs)
- MATS used to project current DVCs without a selected state's contribution
  - Use relative change in model results to scale observed current year DV (DVC) in absence of a state's anthropogenic emissions
  - Difference is state's ozone contribution at each ozone monitoring site
- As in CSAPR, use two sets of DVCs
  - AvgDVC = Average of 2006-2008, 2007-2009 & 2008-2010 DVs
  - MaxDVC = Maximum of 2006-08, 2007-09 & 2008-10 DVs
- CSAPR used significant contribution threshold of 1% of the NAAQS

Appendix A

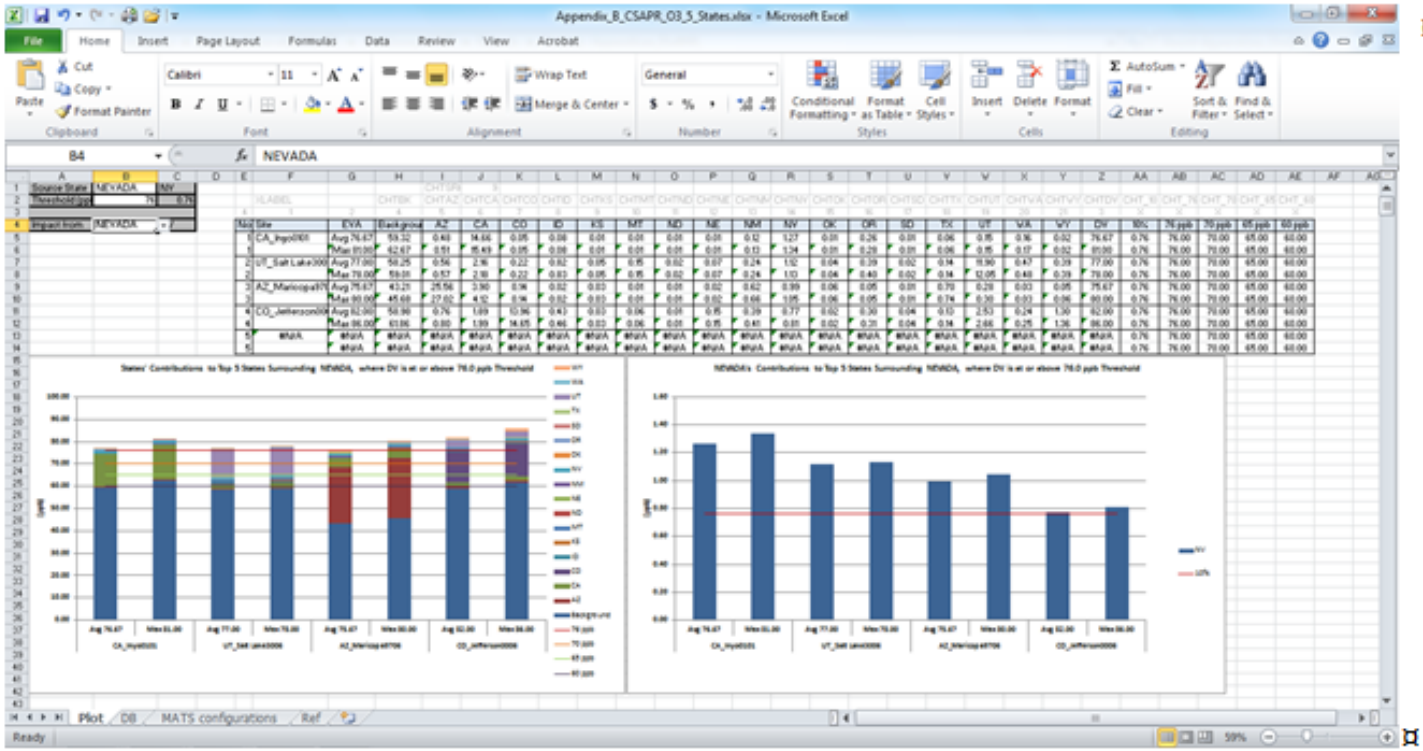
CSAPR-Type Analysis for 2008 Upwind State Highest Contribution to Average and Maximum Ozone Design Values at any Monitoring Site in up to 5 Downwind States using MATS

"Appendix_A_CSAPR_DVO3_5_States.xlsx" (0.4 Mb)

Cell B1 = Select Upwind State (Example for Nevada)

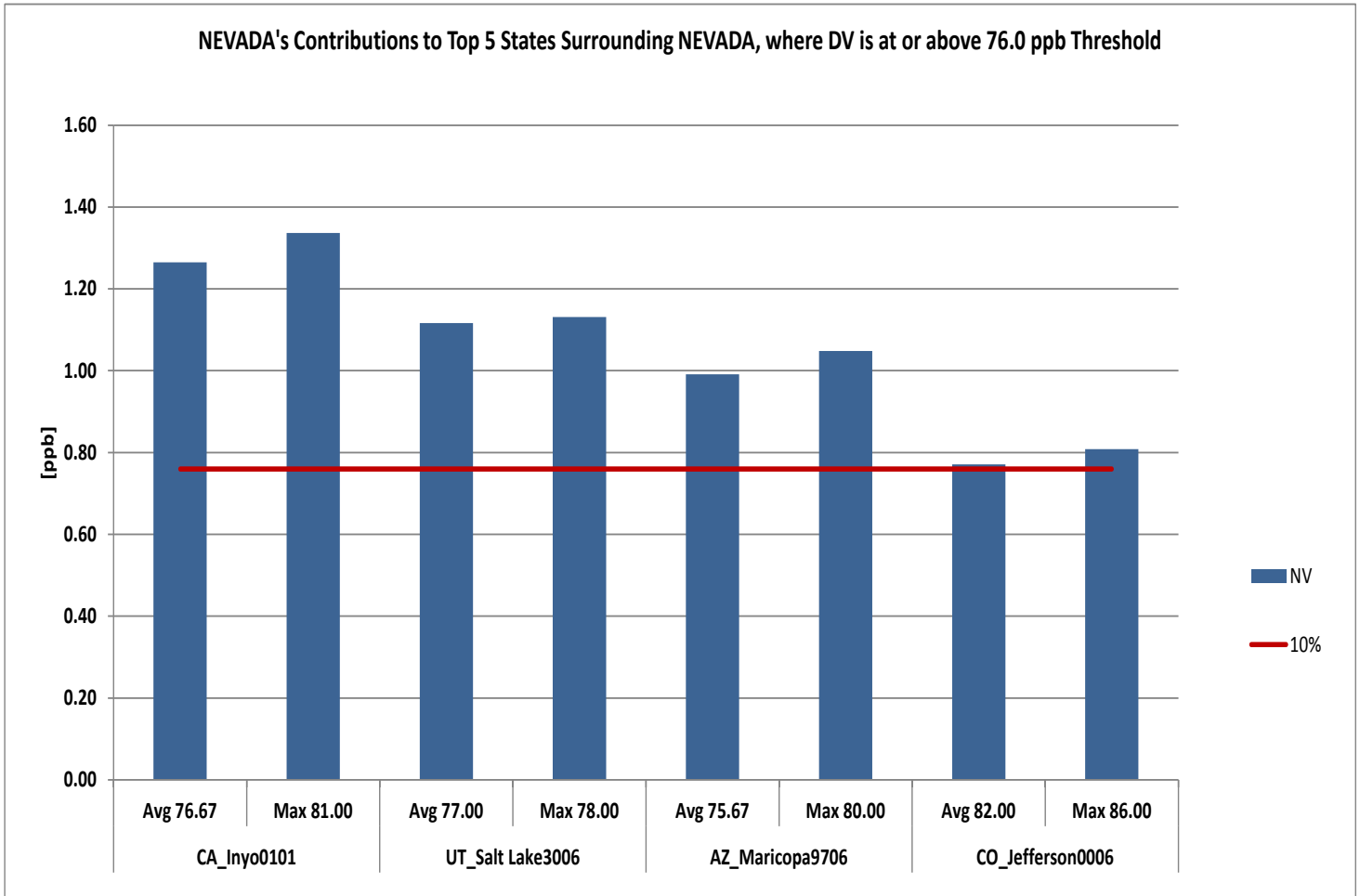
Cell B2 = Select NAAQS Threshold for Analysis (76 ppb for current NAAQS in example)

Cell B4 = Select Upwind State for Contributions (usually same as Cell B1)



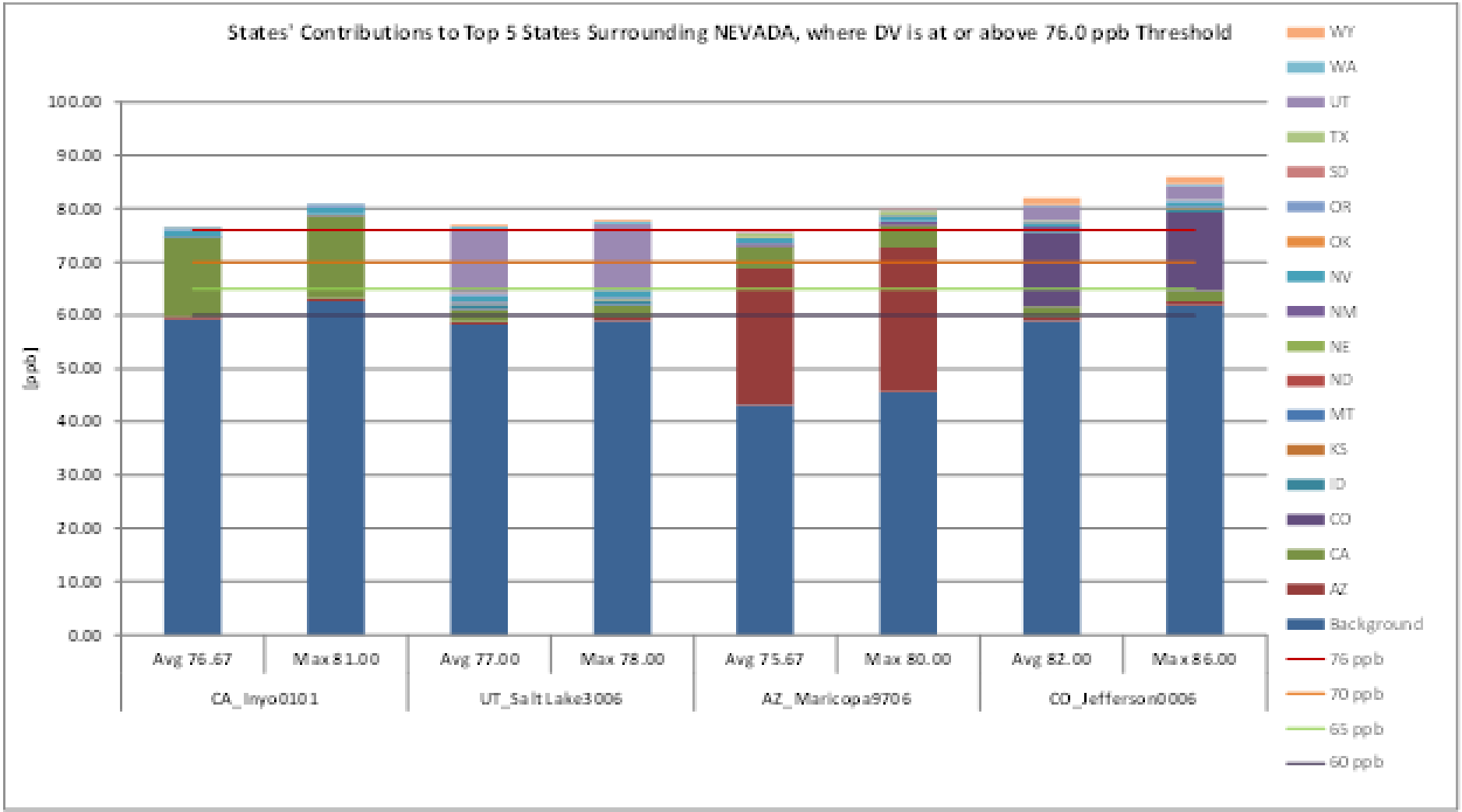
Appendix A: Nevada DV Contribution 5 States

- Example uses current NAAQS threshold (76 ppb) so spreadsheet displays up to five highest monitors in five states with DVC ≥ 76 ppb and Nevada Contribution ≥ 1% of Threshold



Appendix A: Nevada DV Contribution 5 States

- AvgDVC and MaxDVC in five states at monitors with highest Nevada Contribution



Appendix·B¶

State·Contributions·to·Daily·Maximum·8-Hour·Ozone·Concentrations·on·10·Highest·Modeled·Ozone·Days·in·2008·by·Monitoring·Site¶

"Appendix_B_O3_10hi_Model_Days.xlsx"·(20.0·Mb)¶

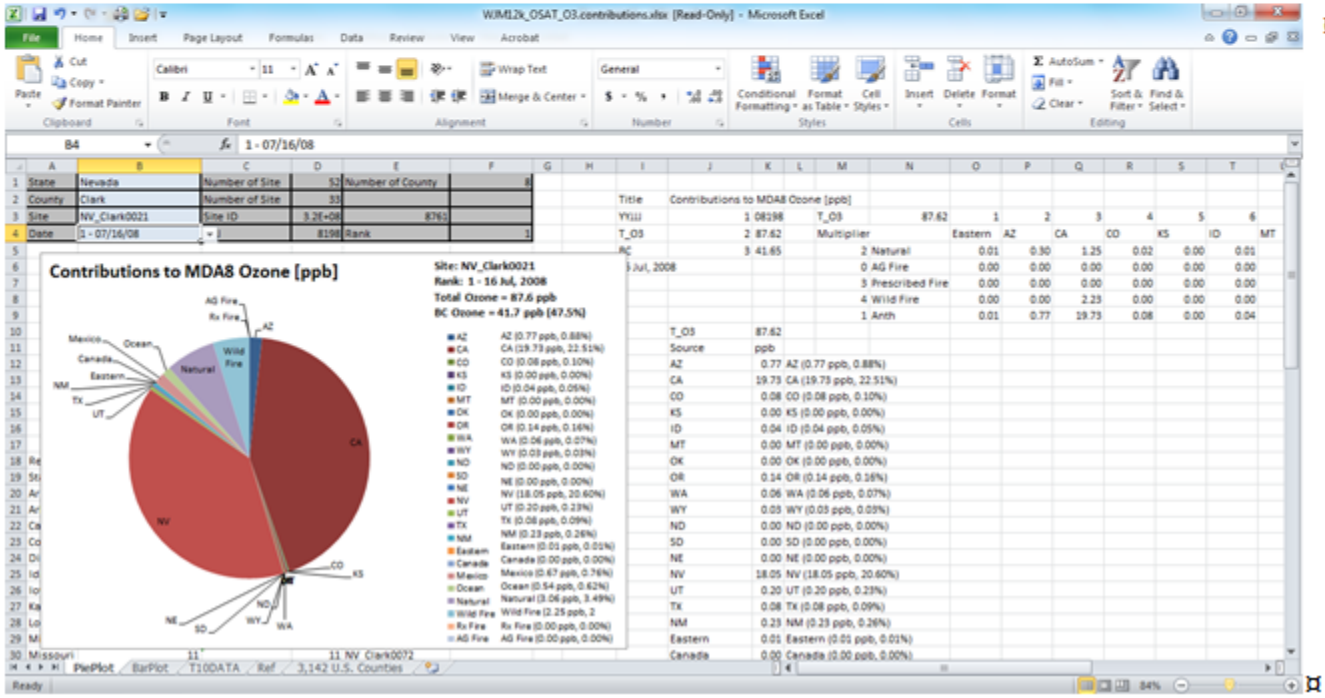
Sheet#1·=·PiePlot¶

Cell·B1·=·State·(Example·for·Nevada)¶

Cell·B2·=·County·(Example·for·Clark·County)¶

Cell·B3·=·Monitoring·Site·(Example·for·NV_Clark0021)¶

Cell·B4·=·Date·of·10·Highest·Modeled·Ozone·Days·(Ranked·1·on·7/16/13·in·example)¶



Appendix B: 4 Highest DMAX8 Clark Cty

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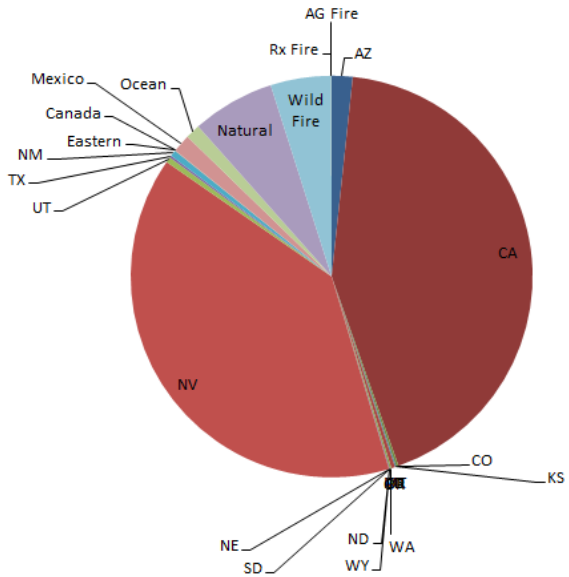
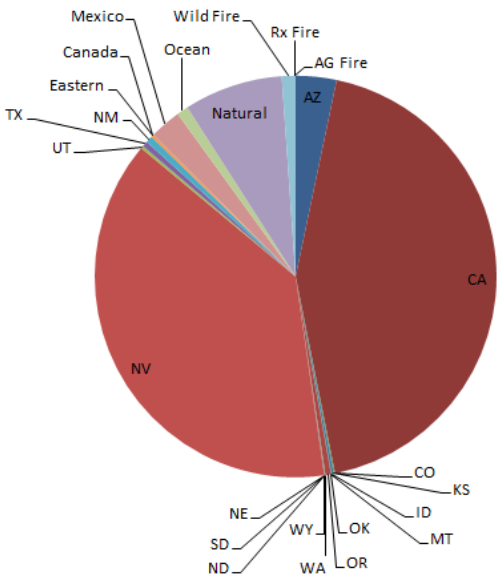
Contributions to MDA8 Ozone [ppb]



Site: NV_Clark0021
Rank: 1 - 16 Jul, 2008
Total Ozone = 87.6 ppb
BC Ozone = 41.7 ppb (47.5%)

AZ	AZ (0.77 ppb, 0.88%)
CA	CA (19.73 ppb, 22.51%)
CO	CO (0.08 ppb, 0.10%)
KS	KS (0.00 ppb, 0.00%)
ID	ID (0.04 ppb, 0.05%)
MT	MT (0.00 ppb, 0.00%)
OK	OK (0.00 ppb, 0.00%)
OR	OR (0.14 ppb, 0.16%)
WA	WA (0.06 ppb, 0.07%)
WY	WY (0.03 ppb, 0.03%)
ND	ND (0.00 ppb, 0.00%)
SD	NE (0.00 ppb, 0.00%)
NE	NV (18.05 ppb, 20.60%)
NV	UT (0.20 ppb, 0.23%)
UT	TX (0.08 ppb, 0.09%)
TX	NM (0.23 ppb, 0.26%)
NM	Eastern (0.01 ppb, 0.01%)
Eastern	Canada (0.00 ppb, 0.00%)
Canada	Mexico (0.67 ppb, 0.76%)
Mexico	Ocean (0.54 ppb, 0.62%)
Ocean	Natural (3.06 ppb, 3.49%)
Natural	Wild Fire (2.25 ppb, 2
Wild Fire	Rx Fire (0.00 ppb, 0.00%)
Rx Fire	AG Fire (0.00 ppb, 0.00%)
AG Fire	

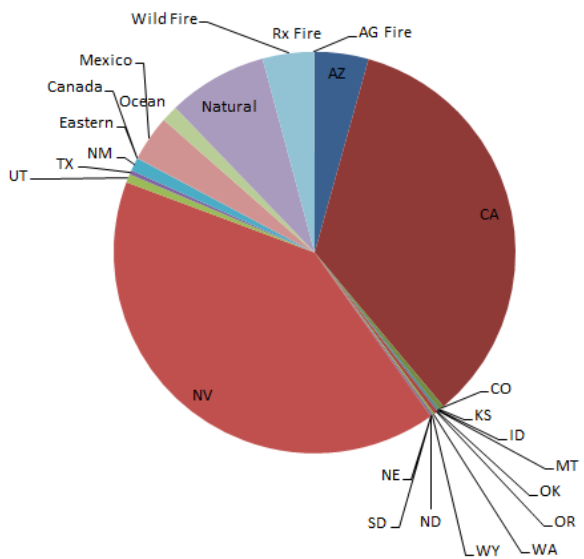
Contributions to MDA8 Ozone [ppb]



Site: NV_Clark0021
Rank: 2 - 15 Aug, 2008
Total Ozone = 85.1 ppb
BC Ozone = 31.7 ppb (37.3%)

AZ	AZ (1.75 ppb, 2.05%)
CA	CA (23.24 ppb, 27.32%)
CO	CO (0.04 ppb, 0.05%)
KS	KS (0.01 ppb, 0.01%)
ID	ID (0.10 ppb, 0.12%)
MT	MT (0.00 ppb, 0.00%)
OK	OK (0.02 ppb, 0.02%)
OR	OR (0.24 ppb, 0.28%)
WA	WA (0.03 ppb, 0.03%)
WY	WY (0.02 ppb, 0.02%)
ND	ND (0.00 ppb, 0.00%)
SD	NE (0.00 ppb, 0.01%)
NE	NV (20.44 ppb, 24.03%)
NV	UT (0.11 ppb, 0.13%)
UT	TX (0.24 ppb, 0.28%)
TX	NM (0.29 ppb, 0.35%)
NM	Eastern (0.10 ppb, 0.12%)
Eastern	Canada (0.00 ppb, 0.01%)
Canada	Mexico (1.36 ppb, 1.60%)
Mexico	Ocean (0.49 ppb, 0.58%)
Ocean	Natural (4.24 ppb, 4.99%)
Natural	Wild Fire (0.58 ppb, 0
Wild Fire	Rx Fire (0.00 ppb, 0.00%)
Rx Fire	AG Fire (0.00 ppb, 0.00%)
AG Fire	

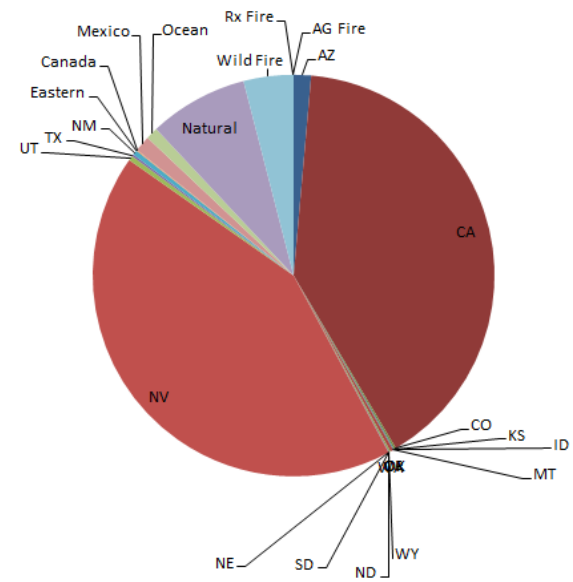
Contributions to MDA8 Ozone [ppb]



Site: NV_Clark0021
Rank: 3 - 14 Jul, 2008
Total Ozone = 84.5 ppb
BC Ozone = 51.3 ppb (60.8%)

AZ	AZ (1.43 ppb, 1.70%)
CA	CA (11.46 ppb, 13.57%)
CO	CO (0.14 ppb, 0.16%)
KS	KS (0.01 ppb, 0.01%)
ID	ID (0.05 ppb, 0.06%)
MT	MT (0.00 ppb, 0.00%)
OK	OK (0.00 ppb, 0.00%)
OR	OR (0.11 ppb, 0.13%)
WA	WA (0.06 ppb, 0.07%)
WY	WY (0.05 ppb, 0.05%)
ND	ND (0.00 ppb, 0.00%)
SD	NE (0.01 ppb, 0.01%)
NE	NV (13.42 ppb, 15.89%)
NV	UT (0.23 ppb, 0.27%)
UT	TX (0.11 ppb, 0.13%)
TX	NM (0.36 ppb, 0.42%)
NM	Eastern (0.00 ppb, 0.00%)
Eastern	Canada (0.00 ppb, 0.00%)
Canada	Mexico (1.22 ppb, 1.45%)
Mexico	Ocean (0.44 ppb, 0.52%)
Ocean	Natural (2.65 ppb, 3.14%)
Natural	Wild Fire (1.38 ppb, 1
Wild Fire	Rx Fire (0.00 ppb, 0.01%)
Rx Fire	AG Fire (0.00 ppb, 0.00%)
AG Fire	

Contributions to MDA8 Ozone [ppb]



Site: NV_Clark0021
Rank: 4 - 17 Jul, 2008
Total Ozone = 82.2 ppb
BC Ozone = 42.7 ppb (51.9%)

AZ	AZ (0.55 ppb, 0.67%)
CA	CA (15.87 ppb, 19.29%)
CO	CO (0.06 ppb, 0.07%)
KS	KS (0.00 ppb, 0.00%)
ID	ID (0.03 ppb, 0.04%)
MT	MT (0.00 ppb, 0.00%)
OK	OK (0.00 ppb, 0.00%)
OR	OR (0.10 ppb, 0.12%)
WA	WA (0.05 ppb, 0.06%)
WY	WY (0.02 ppb, 0.02%)
ND	ND (0.00 ppb, 0.00%)
SD	NE (0.00 ppb, 0.00%)
NE	NV (16.85 ppb, 20.49%)
NV	UT (0.15 ppb, 0.19%)
UT	TX (0.06 ppb, 0.08%)
TX	NM (0.16 ppb, 0.19%)
NM	Eastern (0.03 ppb, 0.03%)
Eastern	Canada (0.00 ppb, 0.00%)
Canada	Mexico (0.50 ppb, 0.61%)
Mexico	Ocean (0.38 ppb, 0.47%)
Ocean	Natural (3.16 ppb, 3.84%)
Natural	Wild Fire (1.59 ppb, 1
Wild Fire	Rx Fire (0.00 ppb, 0.00%)
Rx Fire	AG Fire (0.00 ppb, 0.00%)
AG Fire	

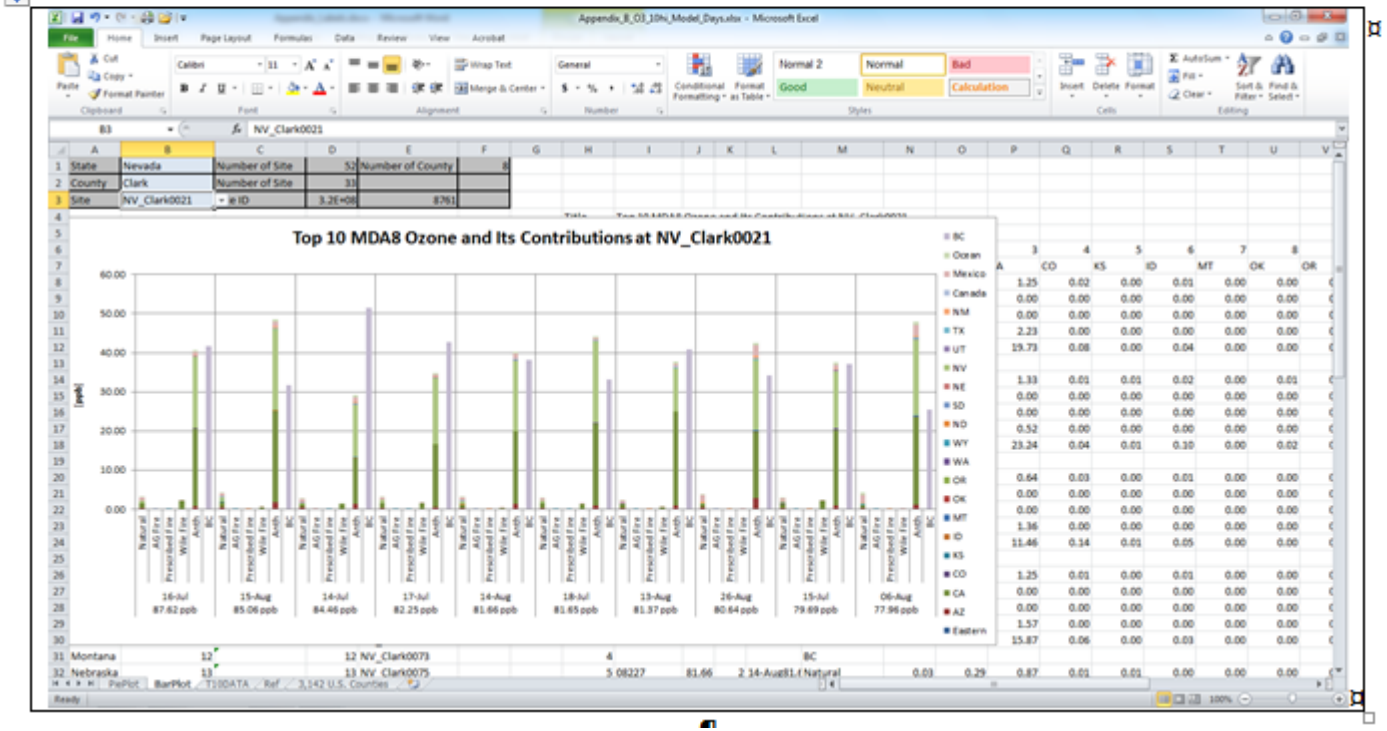
Appendix B: Bar Plot

Sheet·#2·=·BarPlot¶

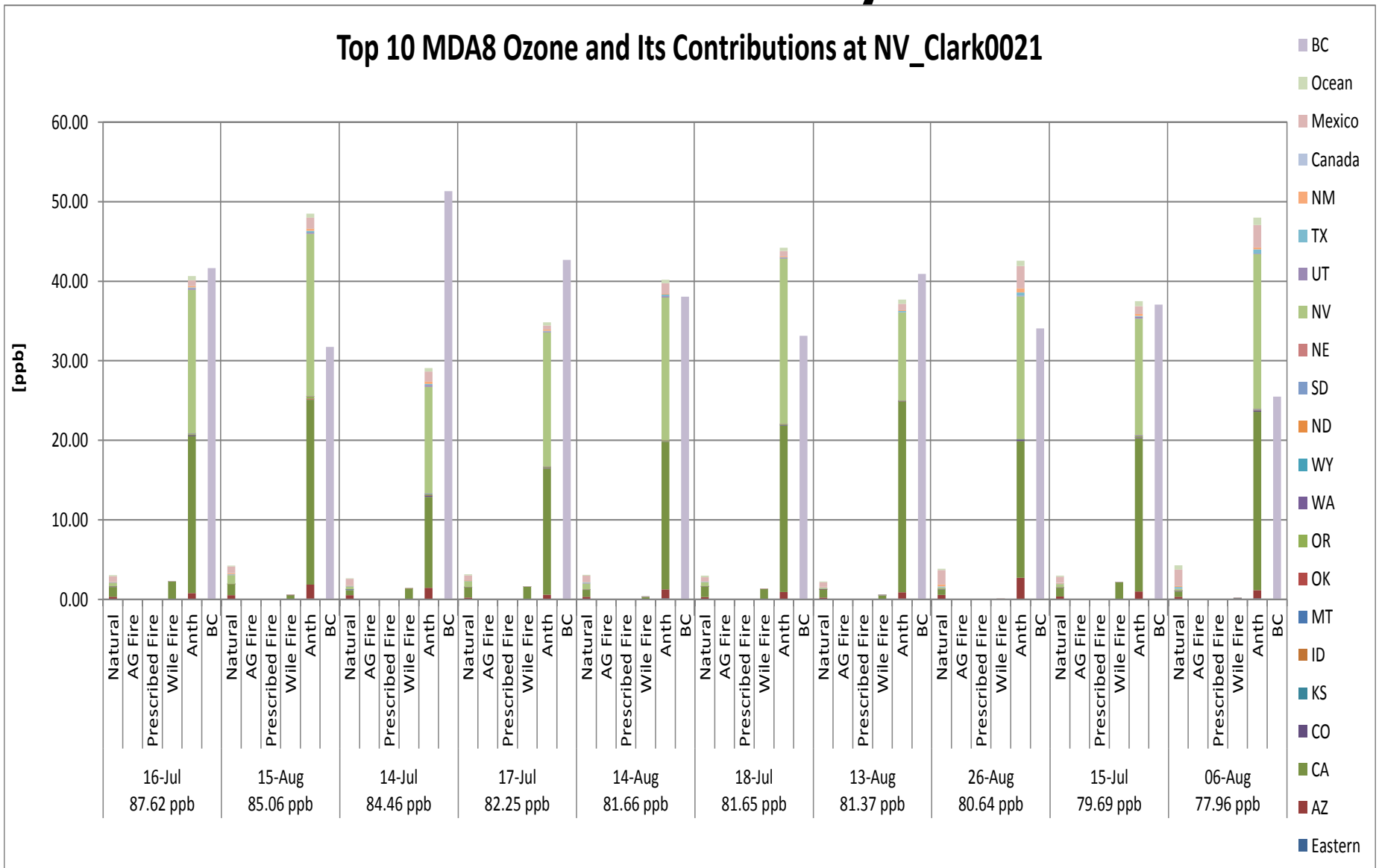
Cell·B1·=·Select·State·(Nevada·in·Example)¶

Cell·B2·=·Select·County·(Clark·in·Example)¶

Cell·B3·=·Select·Monitoring·Site·(NV_Clark0021·in·example)¶



Appendix B: Bar Plot 10 Highest Ozone Days in Clark County



Appendix C: Zipped of Highest and Fourth Highest State Anthropogenic Ozone Contributions when DMAX8 Ozone ≥ 76, 70, 65, 60 and 0 ppb

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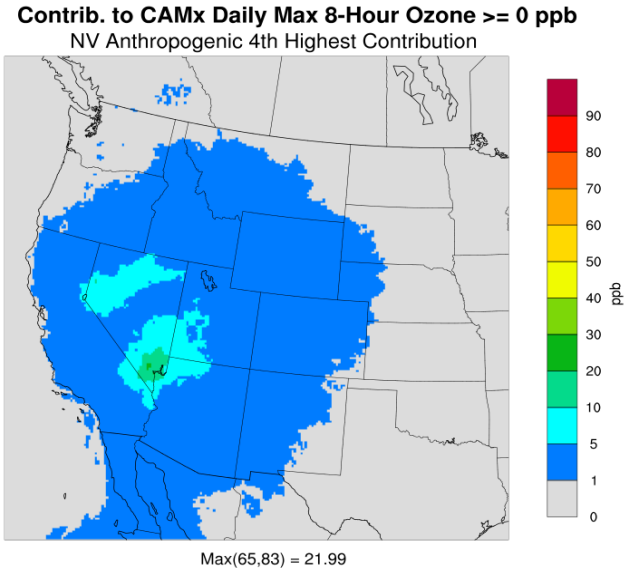
Appendix·C¶

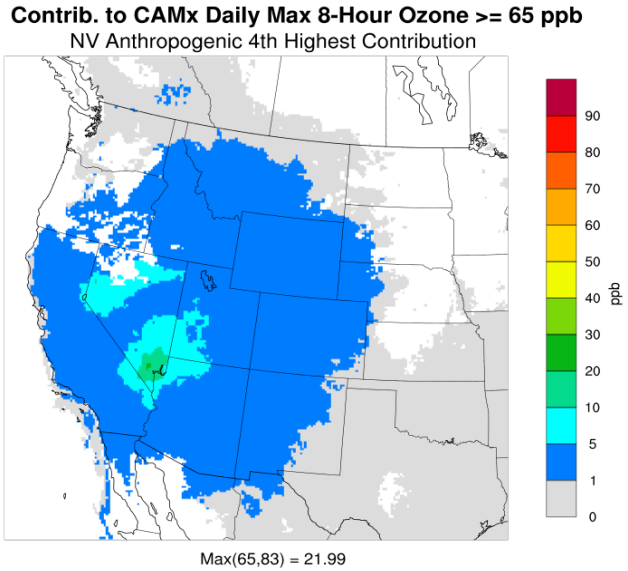
Spatial·Maps·of·State-Specific·Anthropogenic·Emissions·Contributions·to·Highest·and·Fourth·Highest·Modeled·Daily·Maximum·8-Hour·Ozone·Concentrations·during·2008·Greater·than·76·(current·NAAQS),·70,·65,·60·(potential·future·NAAQS)·and·0·(maximum·contribution)·ppb·across·the·12·km·WESTUS·and·36·km·CONUS·Domains¶

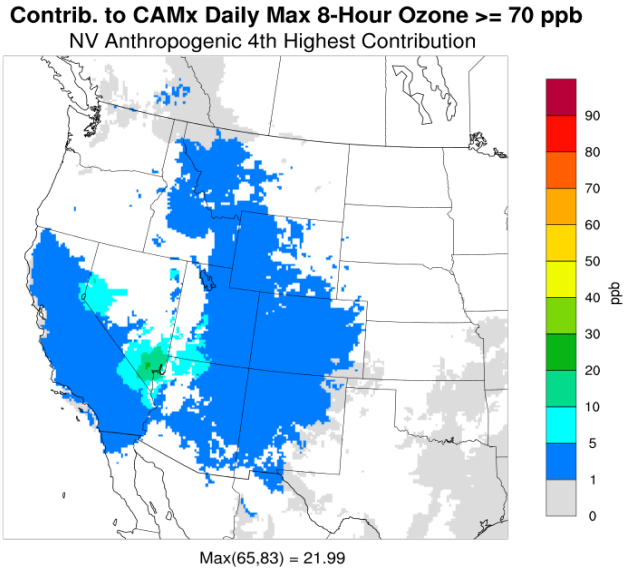
"Appendix_C_Spatial_O3_Anthro_State.zip"·(38.2·Mb)¶

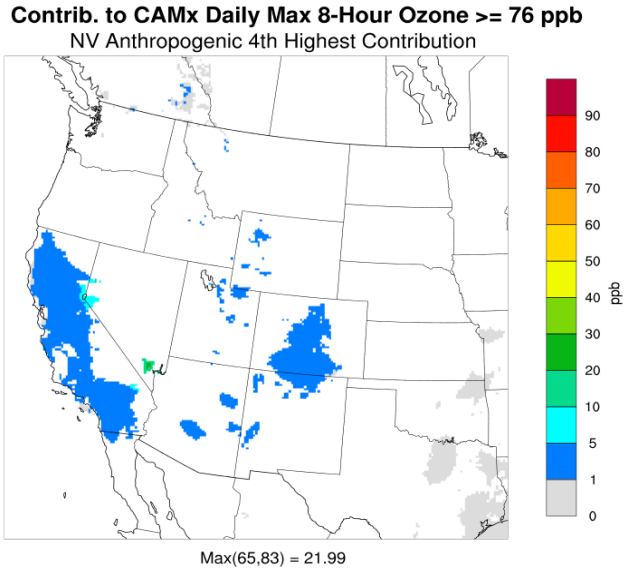
Examples·follow·for·Nevada·and·Fourth·Highest·DMAX8·Ozone¶

Appendix C: Nevada to 4th High DMAX8 Ozone









CSAPR-type PM Contribution Analysis

- MATS run using 2008 Base Case and 2008 Base Case with State Anthropogenic (Anthro+Rx+Ag) Emissions PM Contributions Removed
  - Contributions to both Annual and 24-Hour $PM_{2.5}$ Design Values
- User can specify level of NAAQS for analysis
  - Use CSAPR 1% of NAAQS as significance threshold

Appendix D

CSAPR-Type Analysis for 2008 Upwind State Highest Contribution to Annual $PM_{2.5}$ Design Values in up to Five Downwind States using MATS

"Appendix_D_CSAPR_DVannPM_5_States.xlsx" (12.6 Mb)

Plot1—Up to 5 Downwind States with Maximum Total Annual PM2.5 DV Greater than Threshold with "Significant" Contribution

Cell B2 = Select Upwind State (Example for California)

Cell B3 = Select PM Species (Example for PM2.5)

Cell B4 = Select Annual $PM_{2.5}$ NAAQS Threshold for Analysis (12 µg/m^3 in Example)

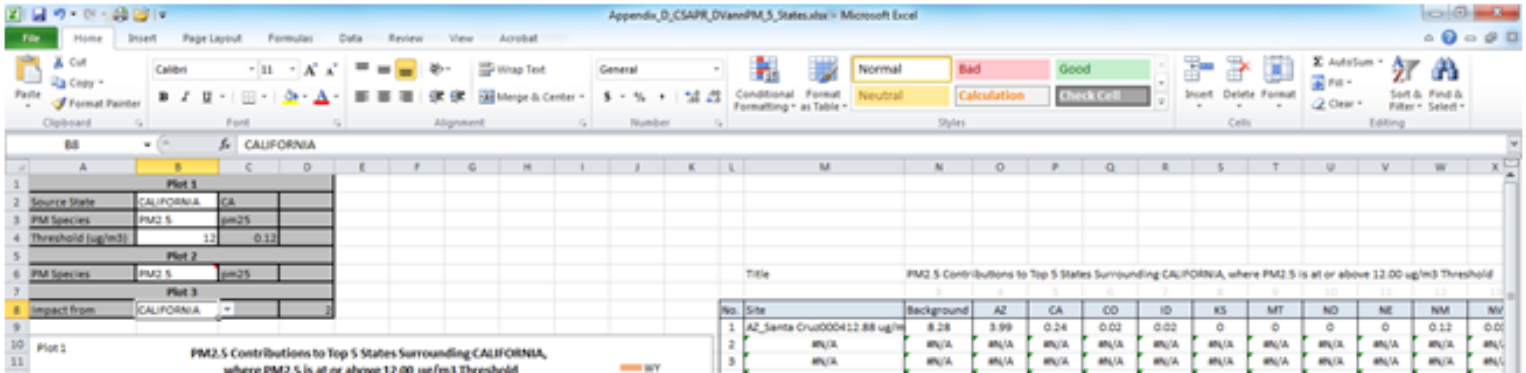
Plot 2 — Total Concentration for Selected PM2.5 Species

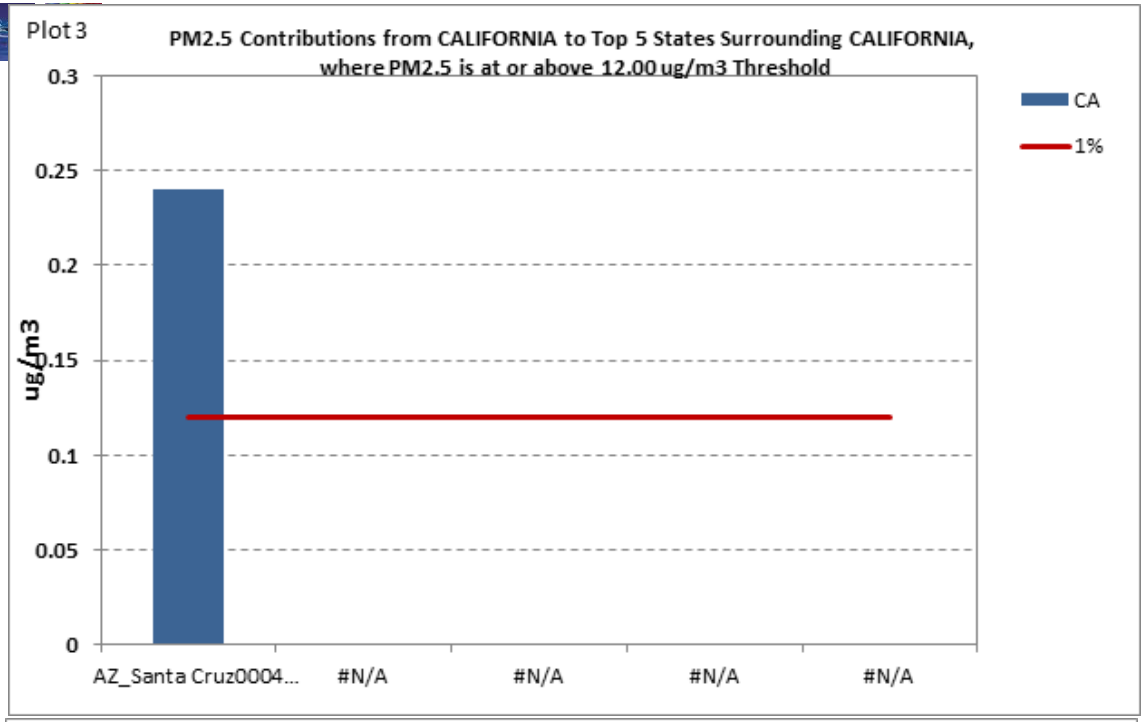
Cell B4 = PM2.5 Species (PM2.5 in Example so same as Plot2)

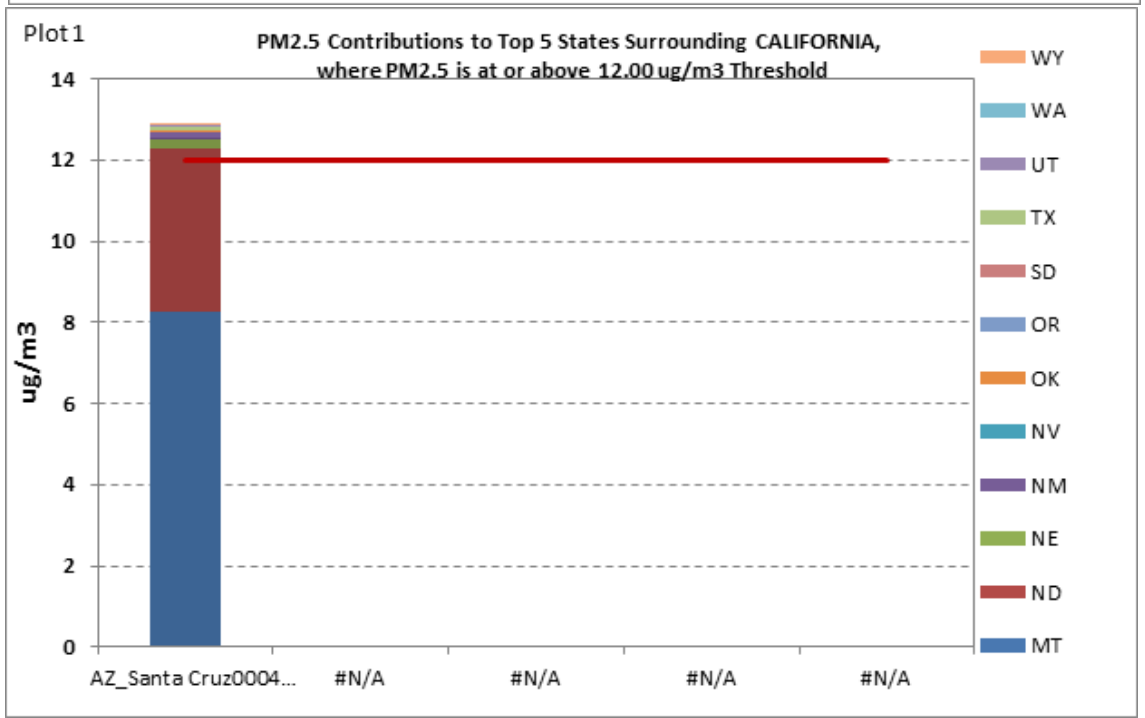
Plot 3 — Upwind State PM2.5 Contribution to Downwind State Annual PM2.5 DV

Cell B8 = Upwind State for Contribution (Example for California)

Plot 4 — Species Contributions from 17 Western States + Remainder







Appendix D
CA Contribution to Annual PM2.5 DVs

Up to Five States

Appendix·E¶

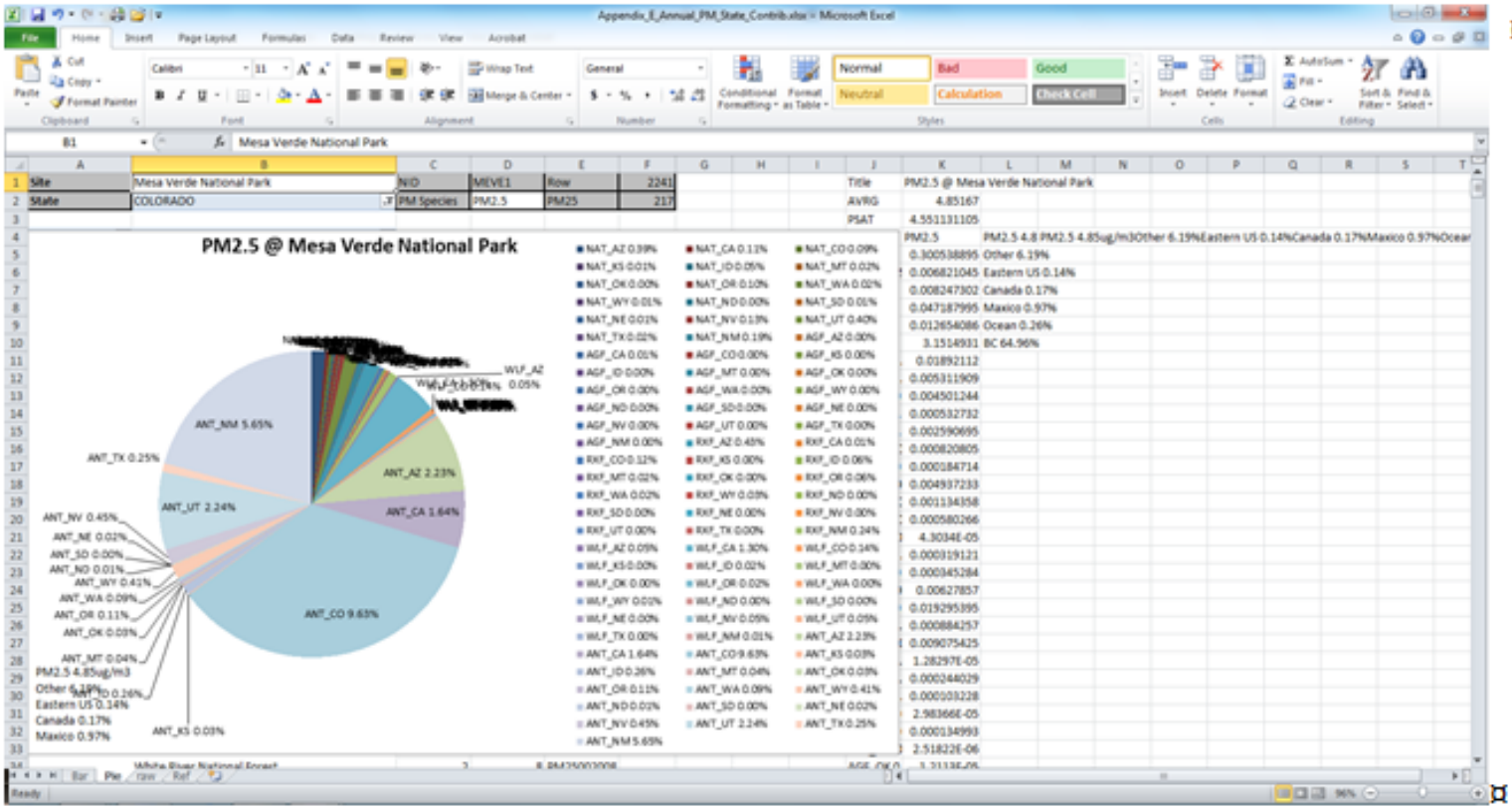
State·Contributions·to·Modeled·Annual·$PM_{2.5}$·Concentrations·in·2008·by·Monitoring·Site¶

Appendix_E_Annual_PM_State_Contrib.xlsx·(23.8·Mb)¶

Cell·B2·=·State·(Example·for·Colorado)¶

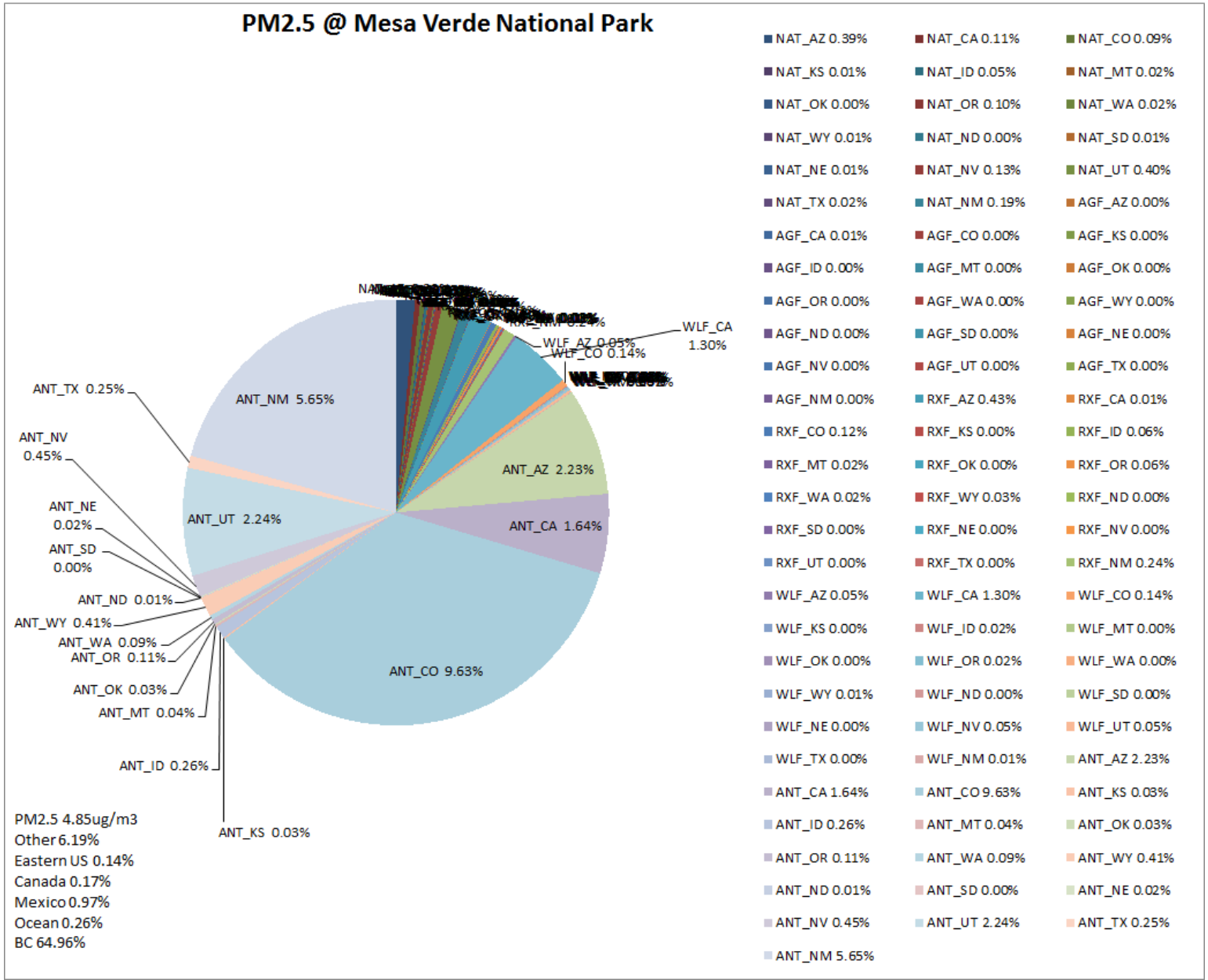
Cell·B1·=·Monitor·in·State·(B2)·(Example·for·Mesa·Verde)¶

¶



¶

Appendix E: Annual PM2.5 at Mesa Verde



Appendix F

CSAPR-Type Analysis for 2008 Upwind State Highest Contribution to 24-Hour $PM_{2.5}$ Design Values in up to Five Downwind States using MATS

"Appendix_F_CSAPR_DV24PM_5_States.xlsx" (12.8 Mb)

Plot1—Up to 5 Downwind States with Maximum Total 24-Hour $PM_{2.5}$ DV Greater than Threshold with "Significant" Contribution

Cell B2 = Select Upwind State (Example for California)

Cell B3 = Select PM Species (Example for PM2.5)

Cell B4 = Select 24-Hour $PM_{2.5}$ NAAQS Threshold for Analysis (35 µg/m^3 in Example)

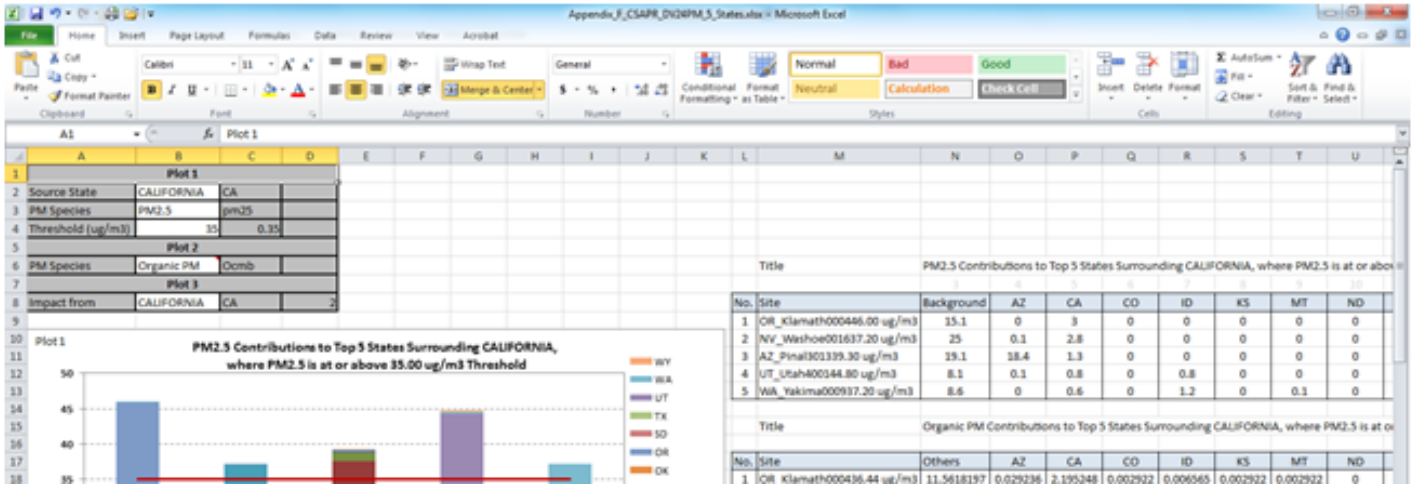
Plot 2 — Total Concentration for Selected $PM_{2.5}$ Species

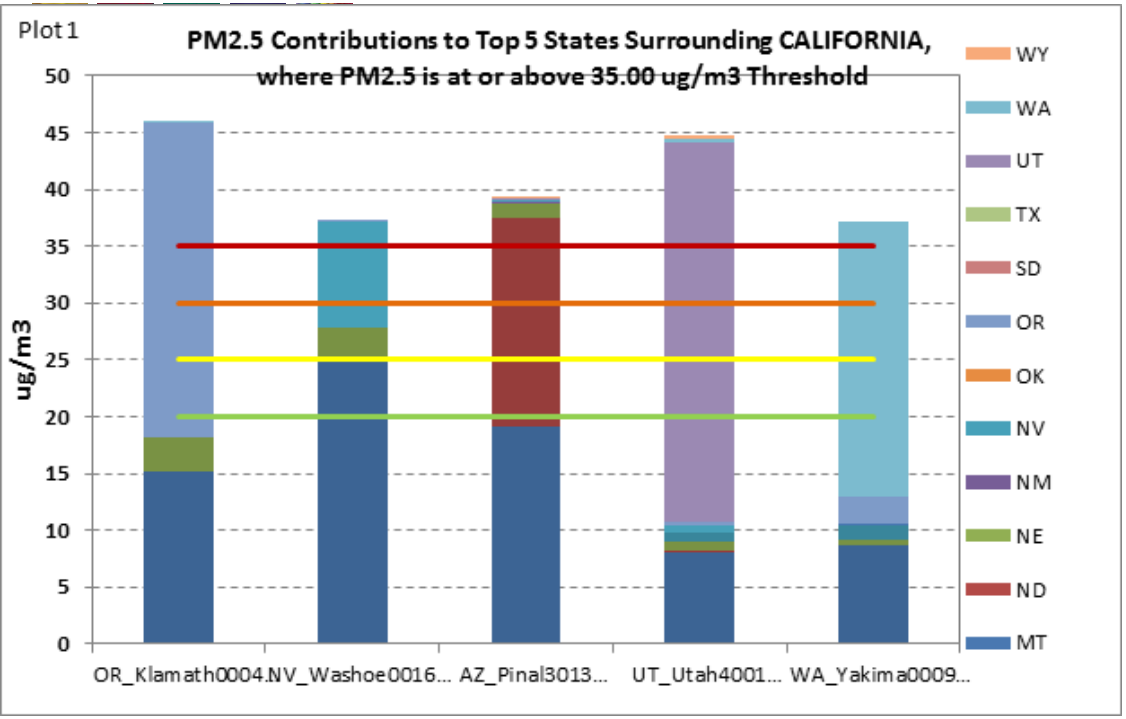
Cell B4 = Select PM2.5 Species (Organic Carbon in Example)

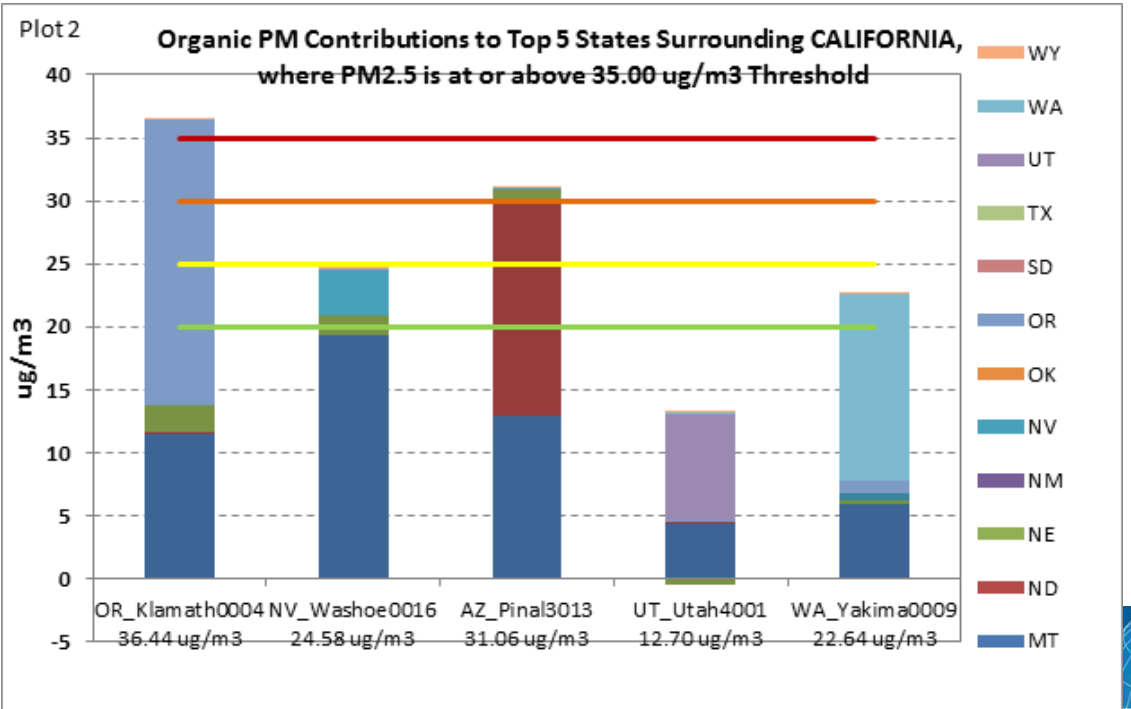
Plot 3 — Upwind State $PM_{2.5}$ Contribution to Downwind State 24-Hour $PM_{2.5}$ DV

Cell B8 = Upwind State for Contribution (Example for California)

Plot 4 — Species Contributions from 17 Western States + Remainder





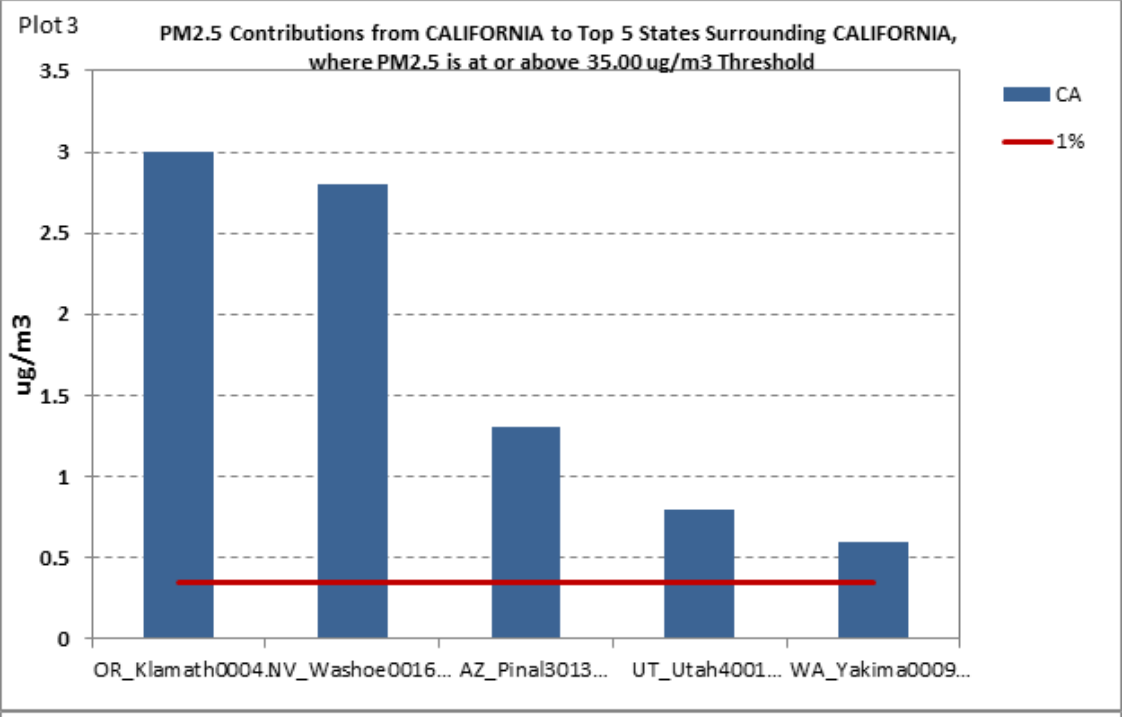


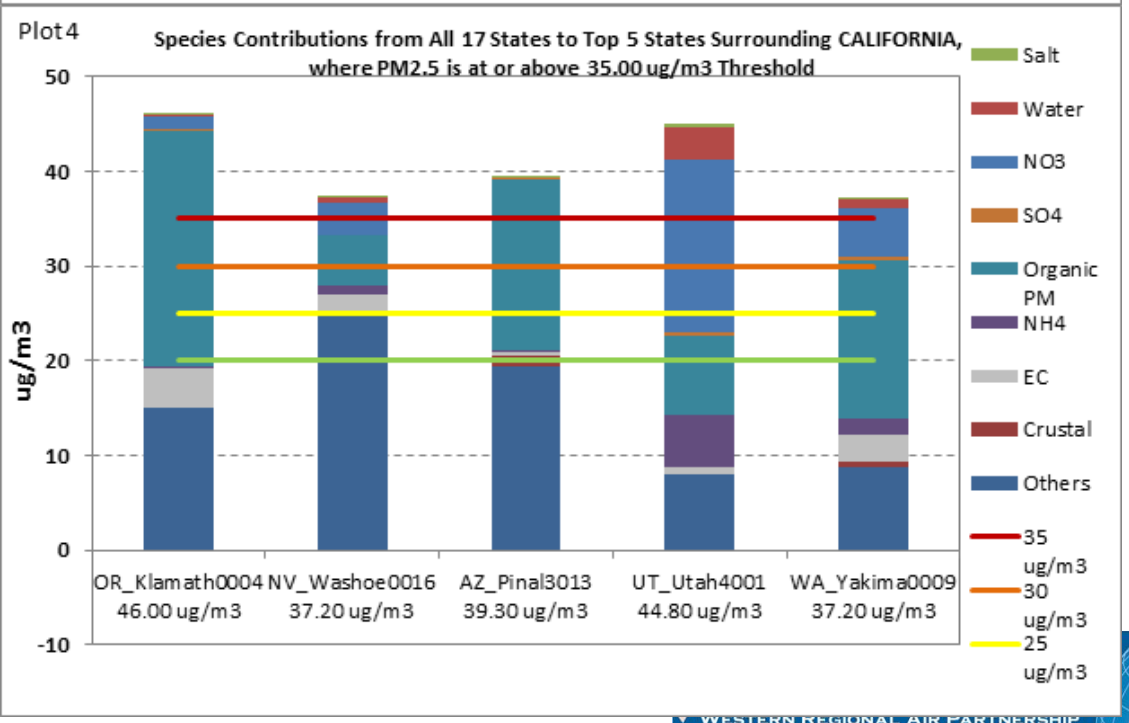
Appendix F

CA Maximum Contribution to Five State 24-Hour $PM_{2.5}$ DVCs Above 35 $\mu g/m^3$

Plot 1: 24-Hour $PM_{2.5}$ DVC

Plot 2: Organic Carbon Contribution to DVC





Appendix F

CA Maximum Contribution to Five State 24-Hour DVCs Above 35 µg/m^3

Plot 3: CA Contribution to 24-Hour $PM_{2.5}$ DVC (red line is 1% of Threshold)

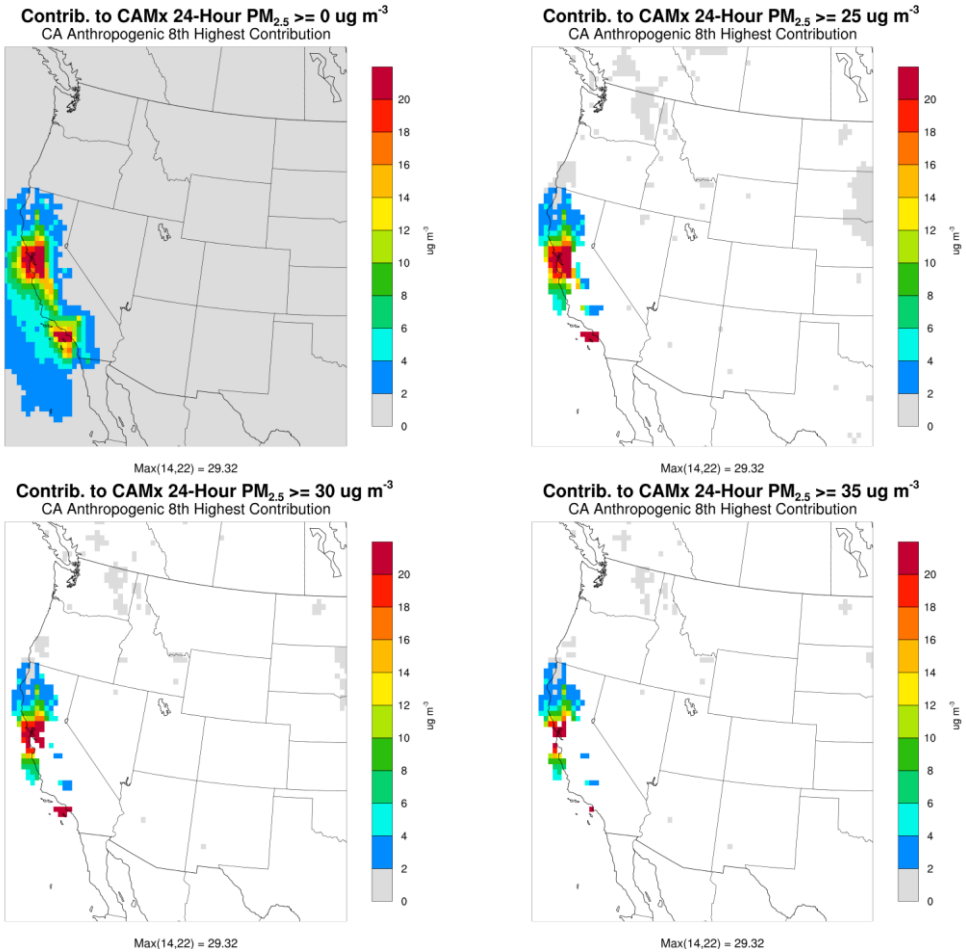
Plot 4: Species Contributions to 24-Hour $PM_{2.5}$ DVC

Appendix·G¶

Spatial·Maps·of·Modeled·State-Specific·Anthropogenic·Emissions·Contributions·to·Highest·(1stmax)·and·Eighth·(8thmax)·Highest·24-Hour·$PM_{2.5}$·Concentrations·during·2008·greater·than·35·(current·NAAQS),·30,·25,·20·and·0·(maximum·contribution)·µg/m3.··¶

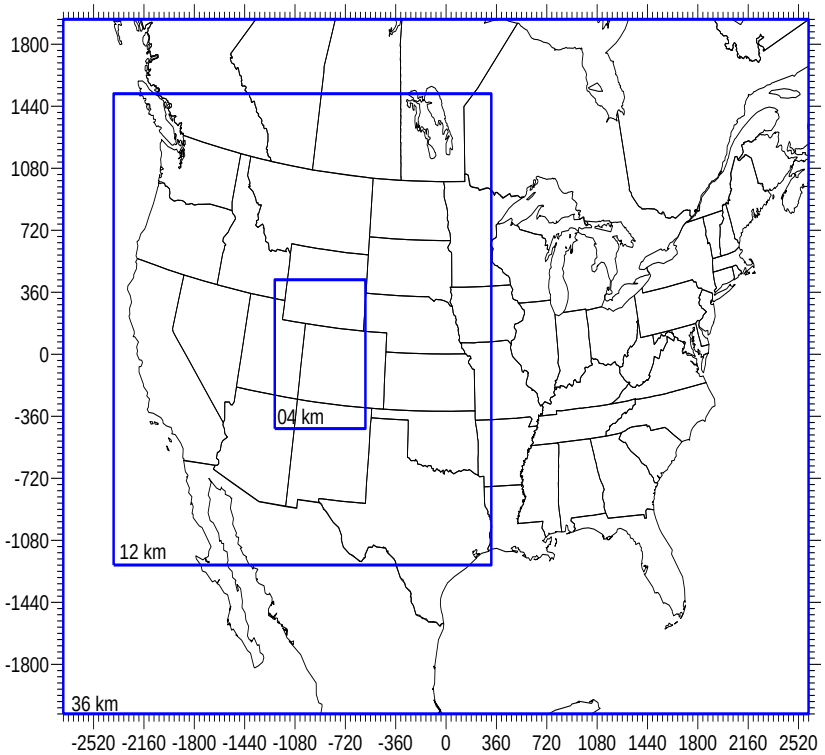
"Appendix_G_Spatial_24PM_Anthro_State.zip"·(13.4·Mb)¶

Example·follow·for·8th·High·24-Hour·$PM_{2.5}$·and·California·¶



Source Category-Specific Source Apportionment

- Separate Ozone and PM Contributions due to 6 Major Source Categories in USA:
  - Natural (Bio, SS, WBD, Ling)
  - Fires (WF+Rx+Ag)
  - Oil and Gas
  - Points
  - Mobile (OR, NR, CMV)
  - Area
- PM Source Apportionment
  - 2008 Annual
  - 36/12 km
  - One Source Region
- Ozone Source Apportionment
  - May-Aug 2008
  - 36/12/4 km
  - Separately for NM, UT, CO & WY



Appendix H

Source Category-Specific Contributions to 8-Hour Ozone Design Values at Monitoring Sites in the 4 km Detailed Source Apportionment Domain (DSAD) using MATS

Cell B1 = Select Monitor in the DSAD Domain (CO_Jefferson0006 in example)

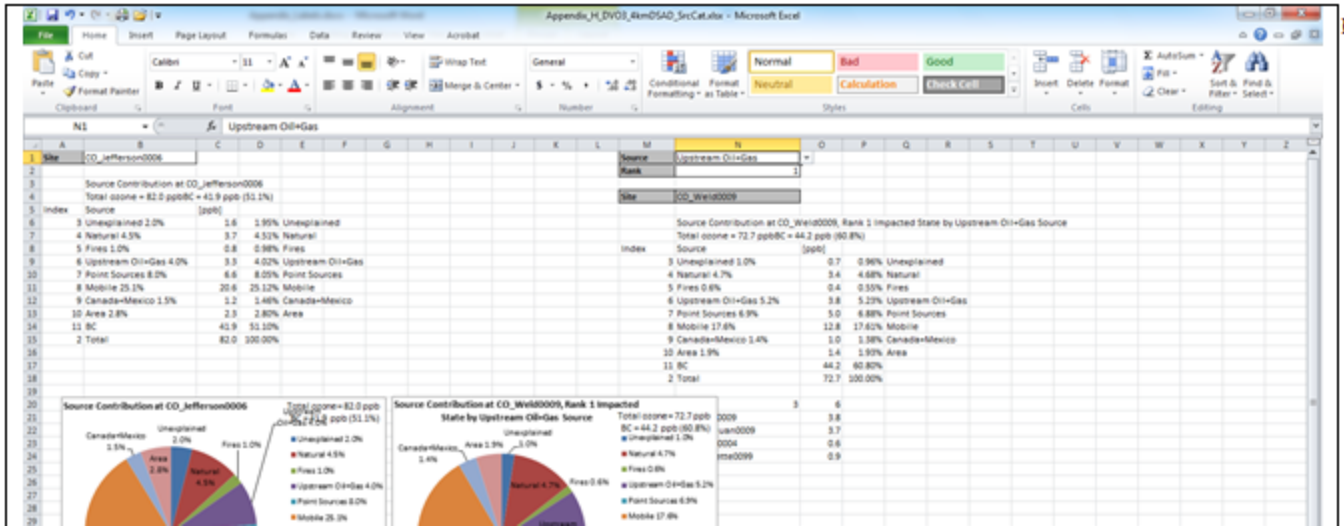
Maximum Contribution to 8-Hour Ozone Design Values in Each DSAD State (CO, NM, UT and WY) due to Major Source Categories using MATS

Cell N1 = Source Category Selected (Upstream Oil and Gas in example)

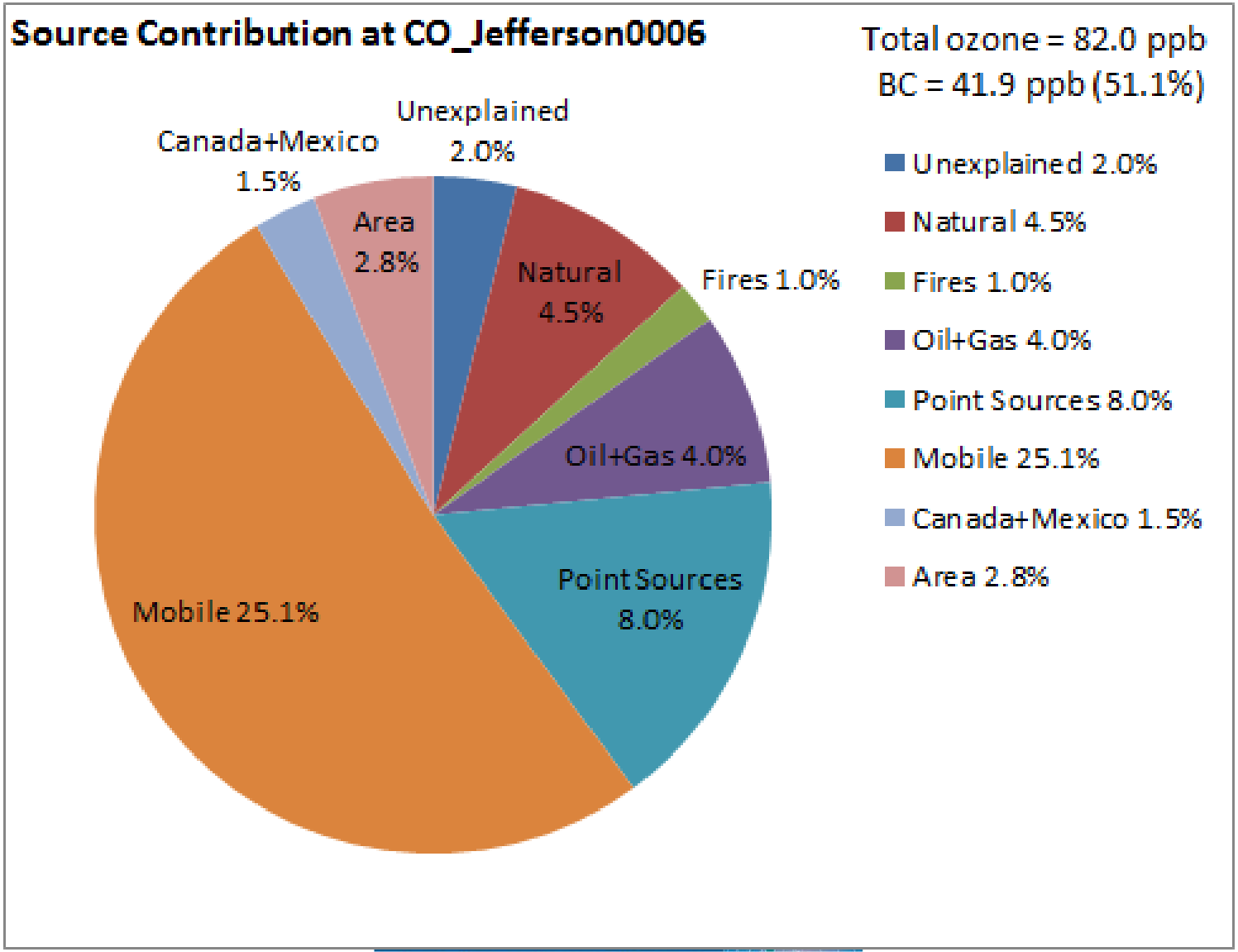
Cell N2 = Rank 1 through 4 (Example selects state with highest O&G contribution)

Cell N4 = Identifies monitor with highest source category contribution (CO_Weld0009 in example)

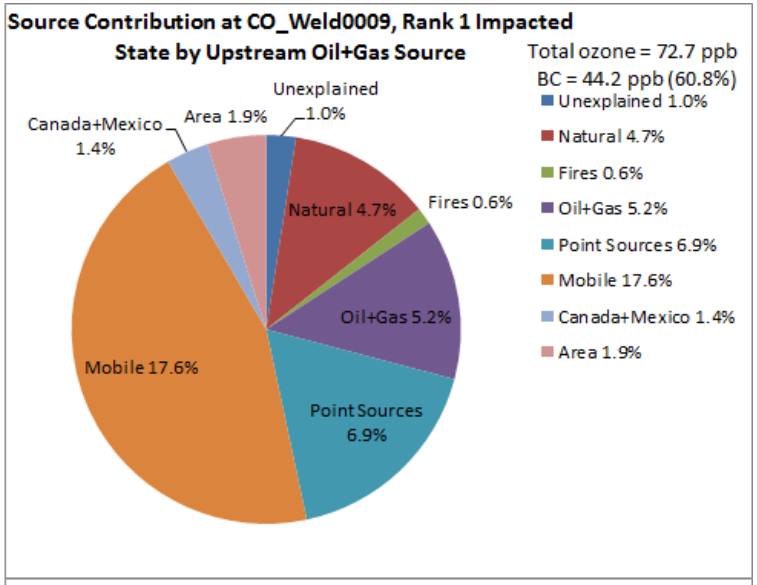
"Appendix_H_DVO3_4kmDSAD_SrcCat.xlsx" (0.09 Mb)

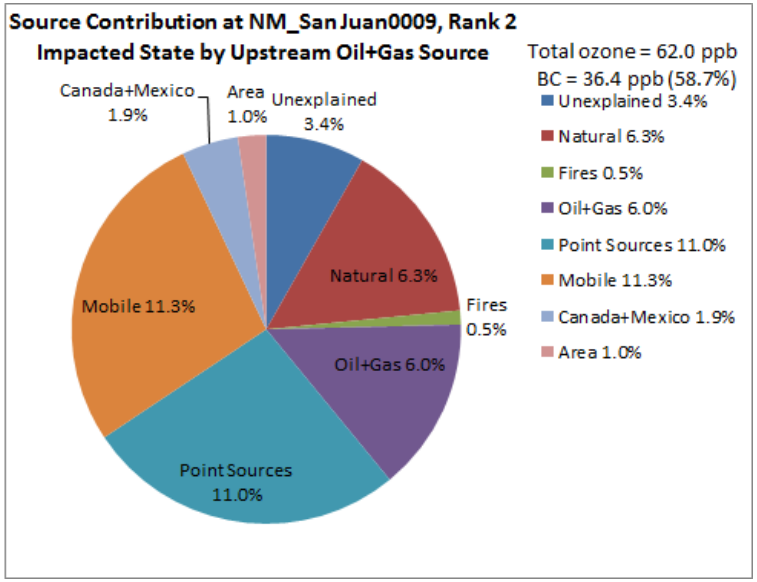


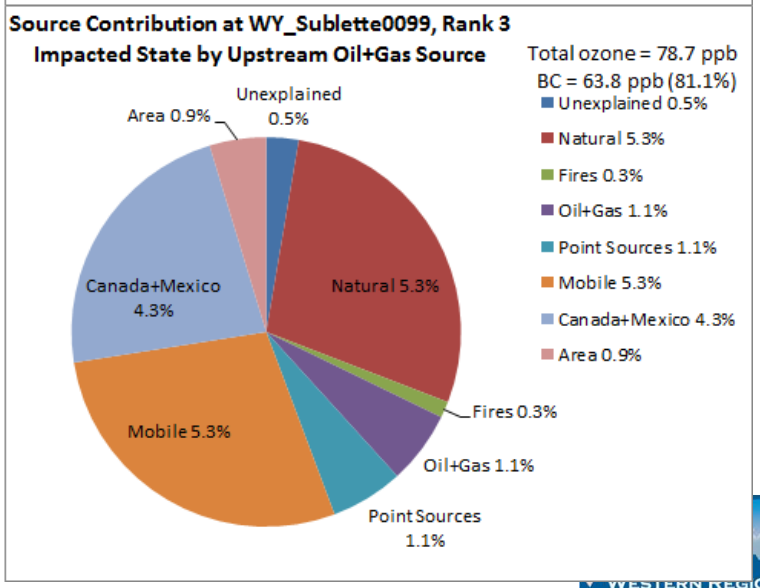
Source Category Contribution to Ozone DVC at Rocky Flats North, Colorado

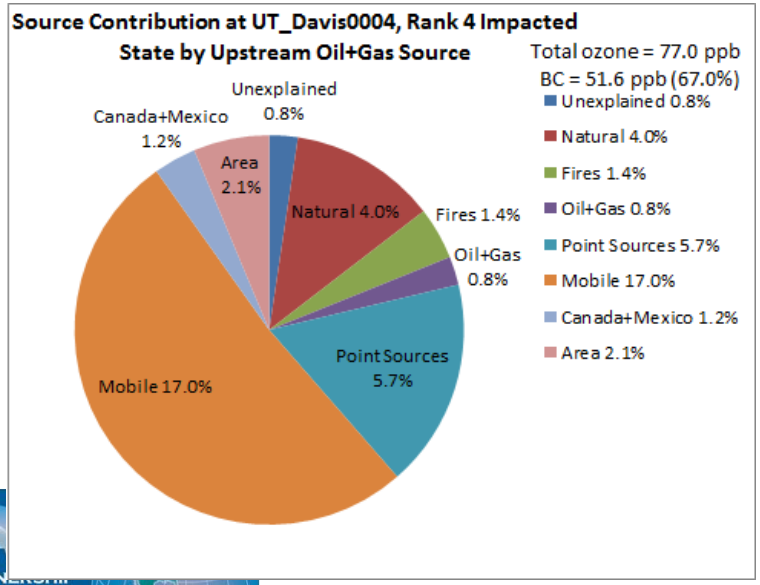


Maximum Oil and Gas Contribution to Ozone DVCs at any site in CO, NM, WY and UT (May-Aug 2008)









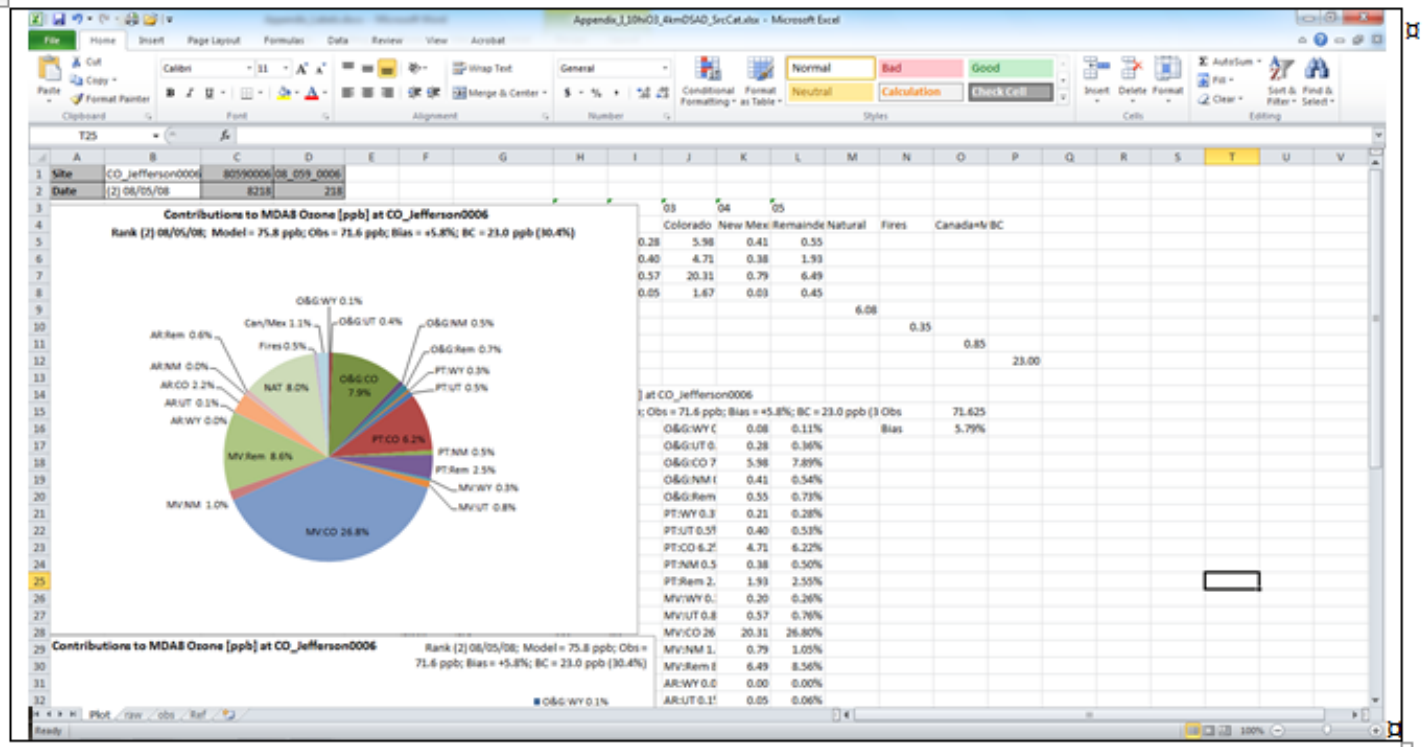
Appendix·I¶

Source·Category-Specific·Contributions·to·Ten·Highest·Modeled·Daily·Maximum·8-Hour·Ozone·Concentrations·at·Monitoring·Sites·in·the·4·km·Detailed·Source·Apportionment·Domain·(DSAD)¶

"Appendix_I_10hiO3_4kmDSAD_SrcCat.xlsx"·(2.3·Mb)¶

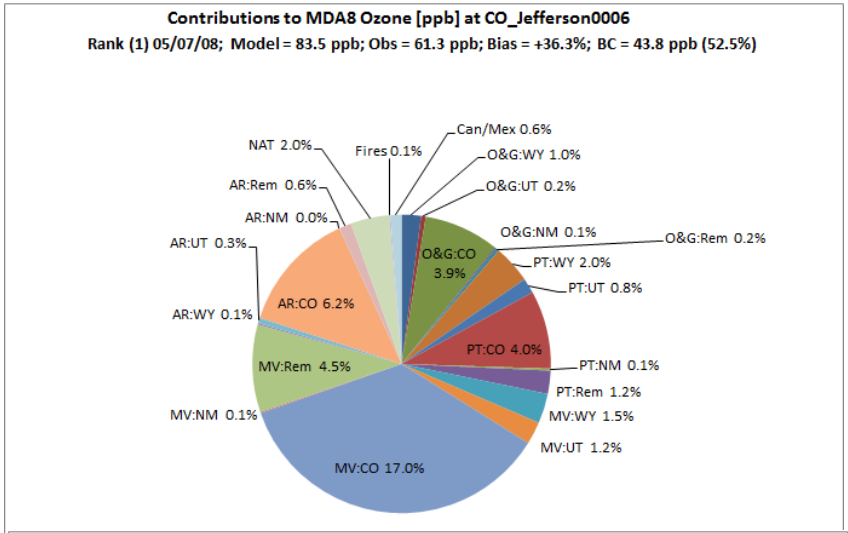
Cell·B1·=·Select·Monitor·in·the·DSAD·Domain·(CO_Jefferson0006·in·example)¶

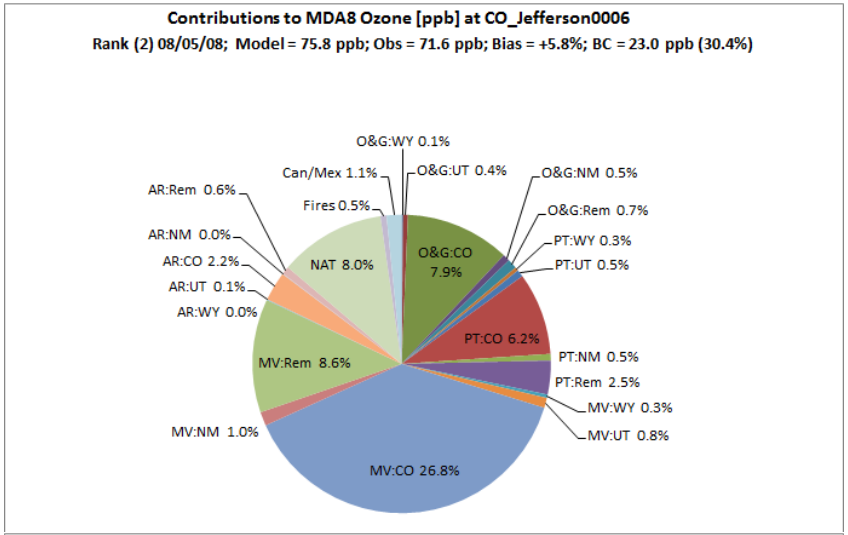
Cell·B2·=·Select·Rank·1·through·10·(2·in·example·that·gives·08/05/08·date)¶

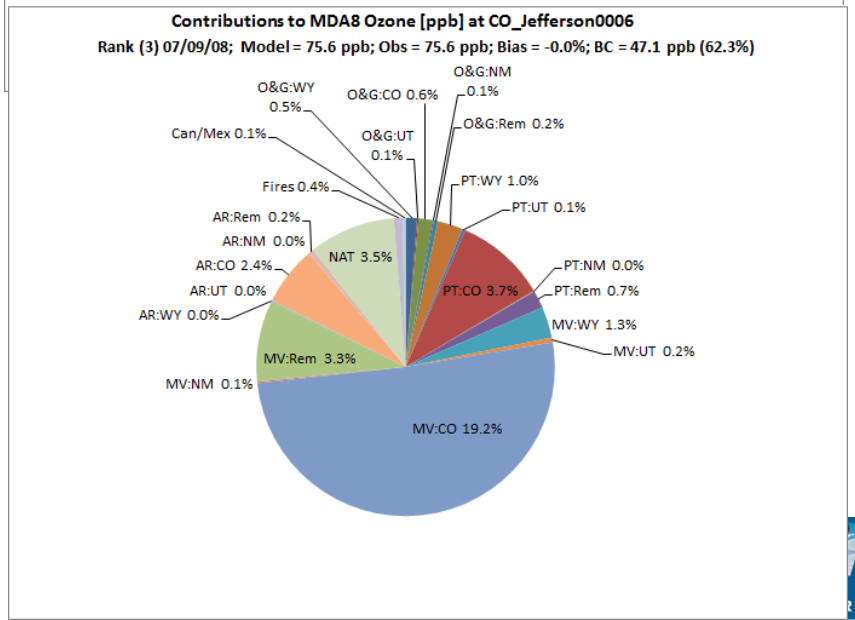


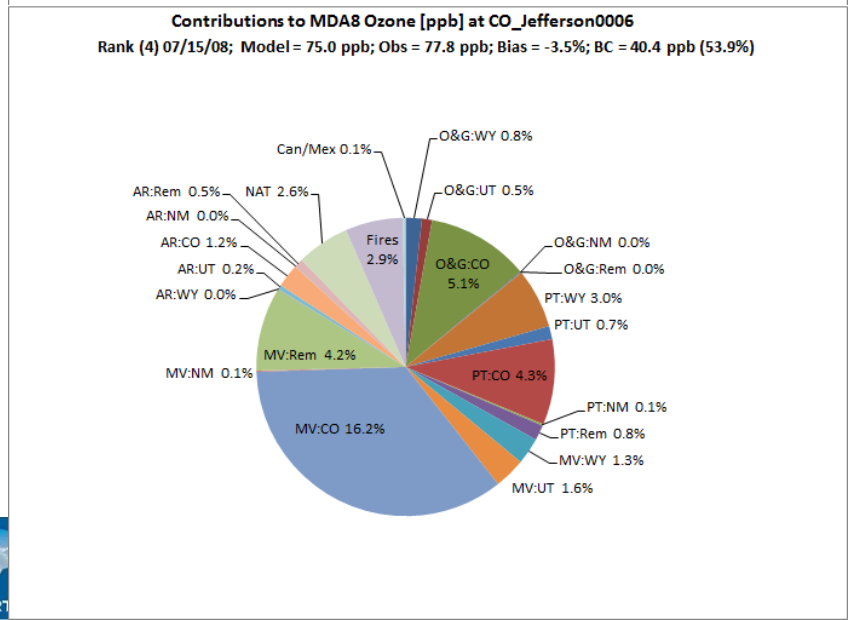
¶

Source Category Contributions to Four Highest Modeled DMAX8 Ozone Days at Rocky Flats North, CO









Appendix·J¶

Source·Category-Specific·Contributions·to·Annual·$PM_{2.5}$.Design·Values·at·Monitoring·Sites·in·the·12·km·WESTUS·Domain·using·MATS¶

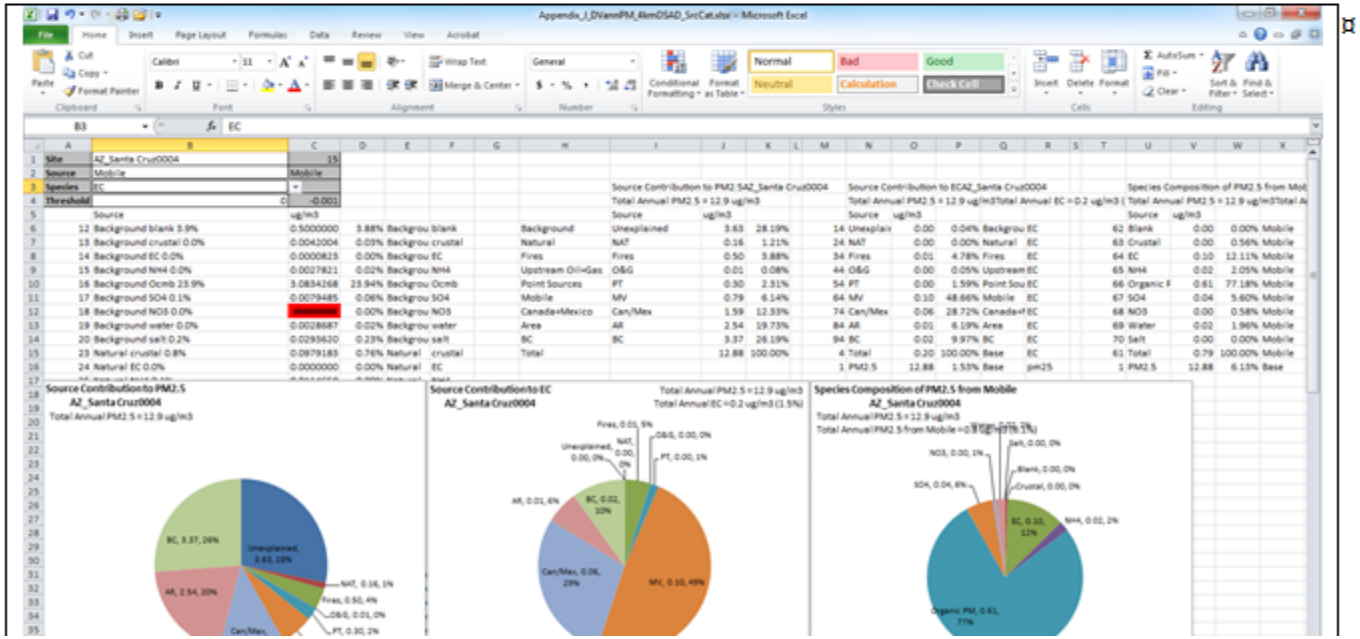
"Appendix_J_DVannPM_12kmWESTUS_SrcCat.xlsx"·(1.8·Mb)¶

Cell·B1·=·Select·Monitor·in·the·12·km·WESTUS·Domain·for·Contributions·to·Annual·$PM_{2.5}$·Design·Value·(AZ_SantaCruz0004·in·example)¶

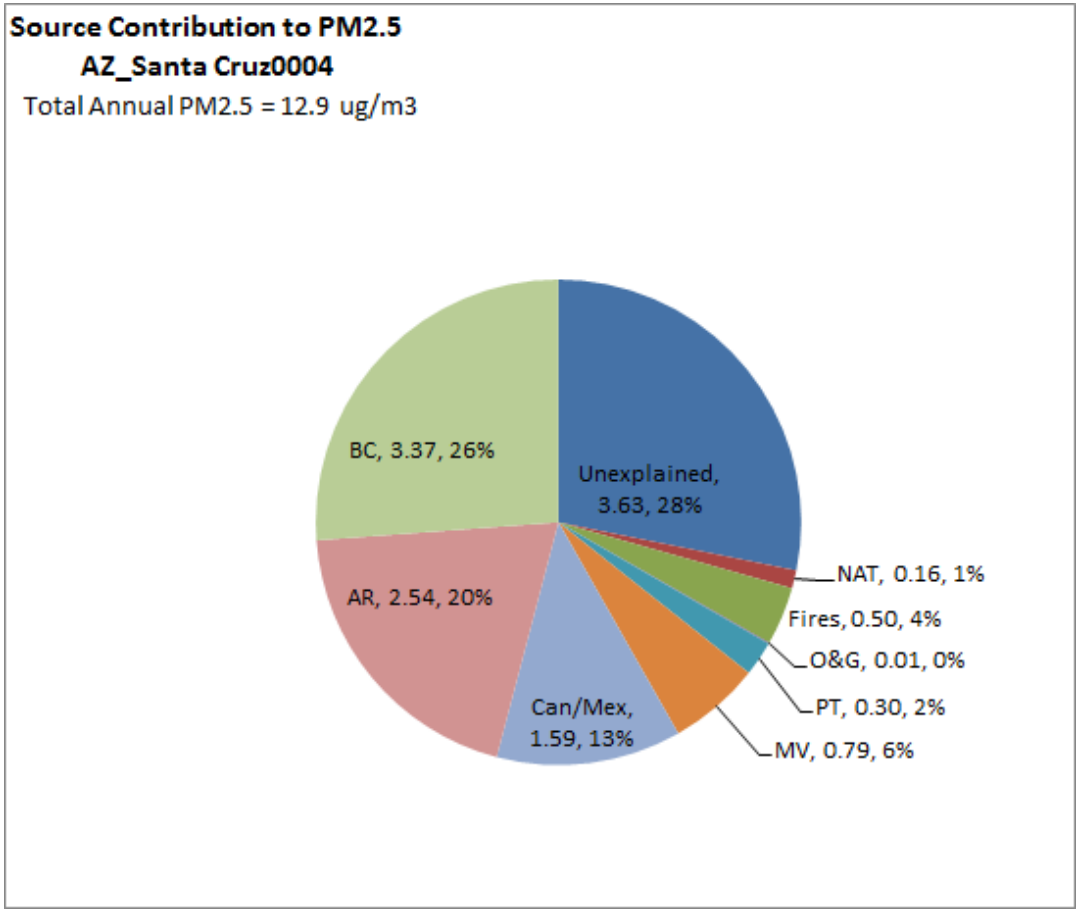
Cell·B2·=·Select·Source·Category·that·will·give·second·plot·of·contributions·for·that·Source·Category·(Mobile·in·example)¶

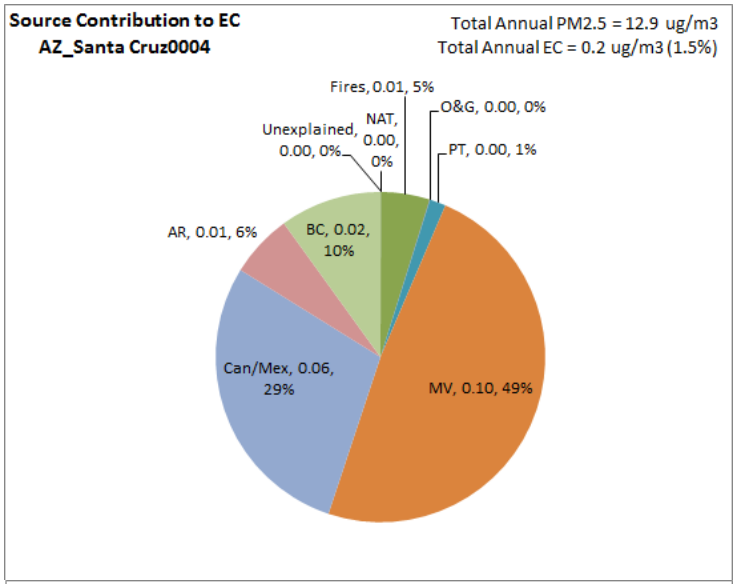
Cell·B3·=·Select·PM·Species·that·will·give·third·plot·of·contributions·for·that·Species·(EC·in·example)¶

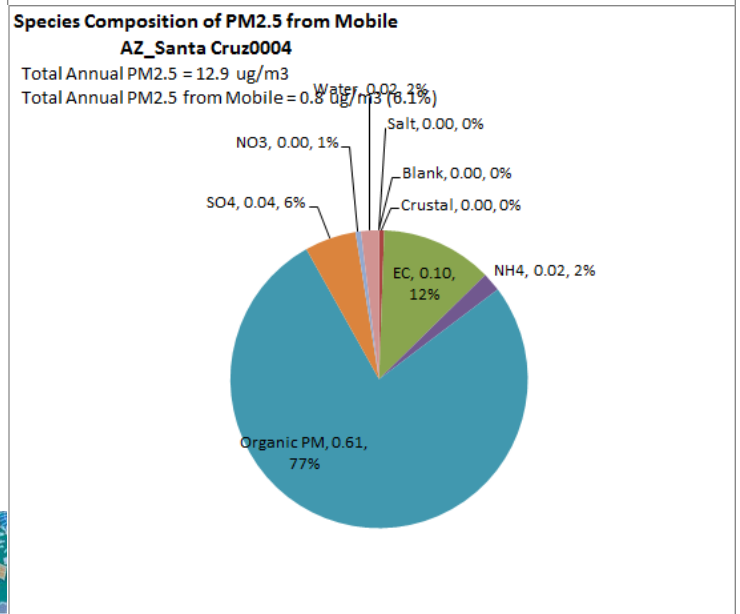
¶



Appendix J: MATS Source Category Contributions to Annual $PM_{2.5}$ DVC at AZ_Santa Cruz004







Unexplained = SOA, Blank Correction, nonlinearities in MATS

Appendix K

Source Category-Specific Contributions to Modeled Annual $PM_{2.5}$ Concentrations ($\mu g/m^3$) at Monitoring Sites in the 12 km WESTUS Domain

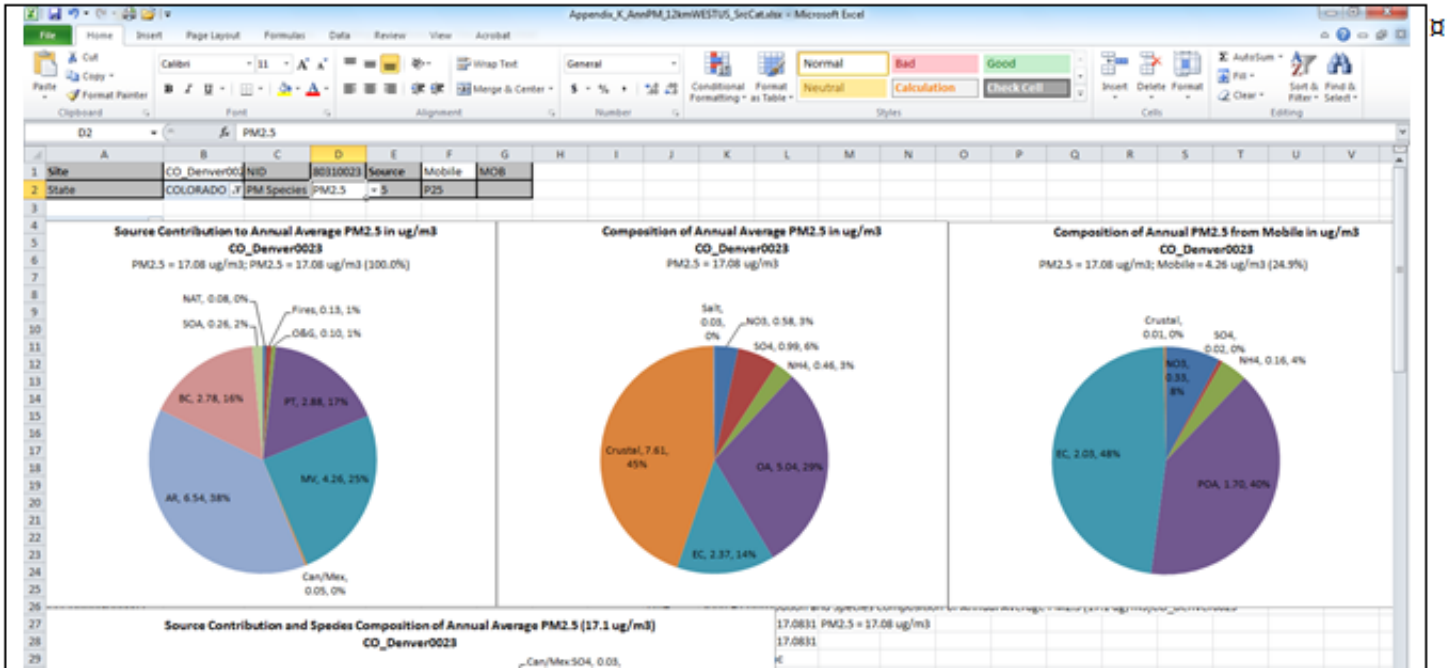
"Appendix_K_AnnPM_12kmWESTUS_SrcCat.xlsx" (4.0 Mb)

Cell B2 = Select State for Monitoring Site (Colorado in example)

Cell B1 = Select Monitoring Site (CO_Denver0023 in example)

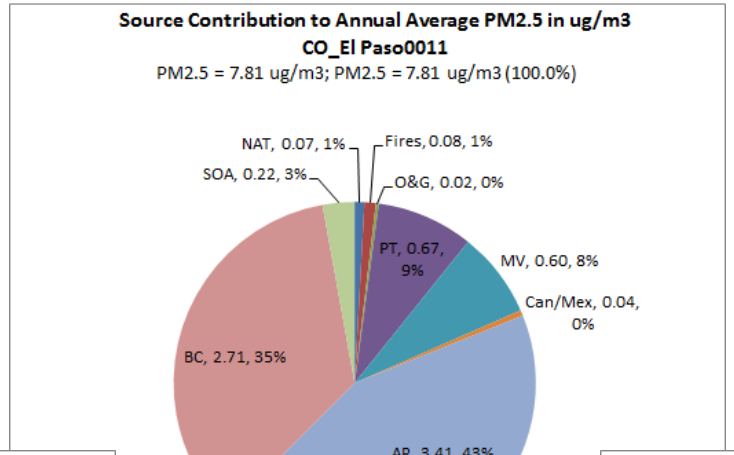
Cell D2 = Select PM Species for Source Apportionment Pie Chart (PM2.5 in example)

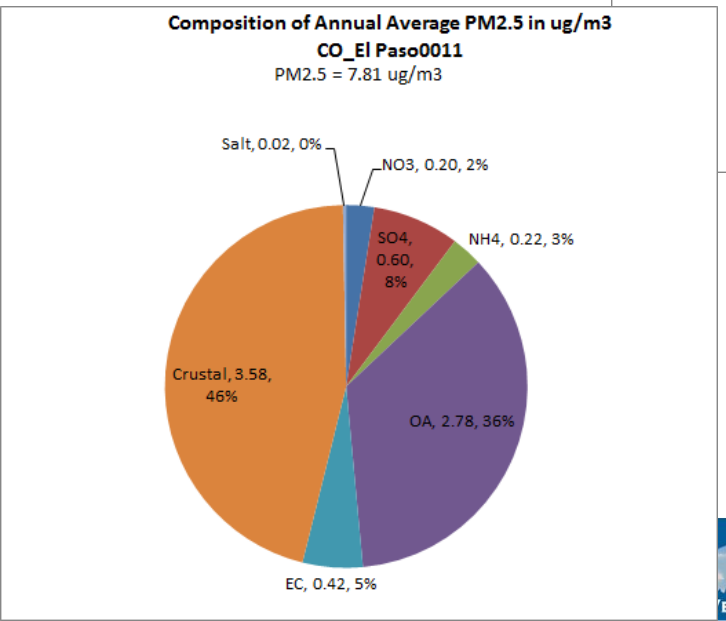
Cell F1 = Select Source Category for Additional Pie Chart (Mobile in example)

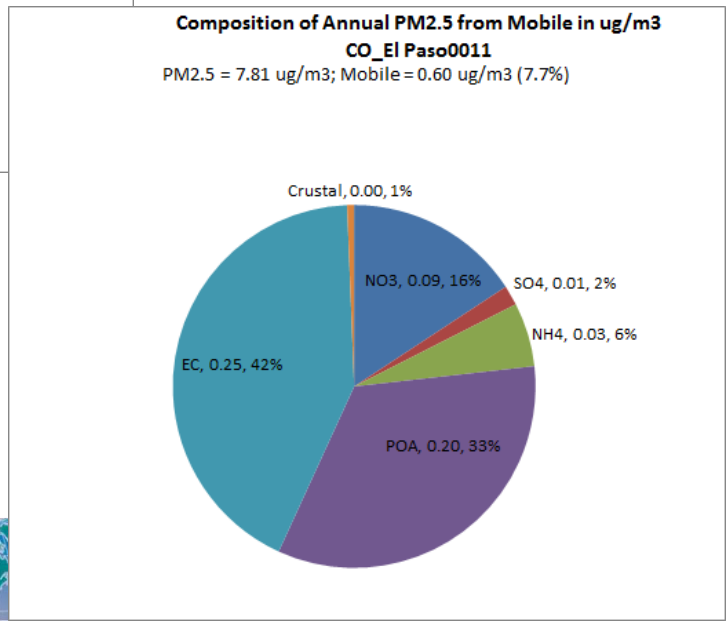


Appendix K: Contributions to Modeled 2008 Annual $PM_{2.5}$ Mass at CO_Denver00223 by:

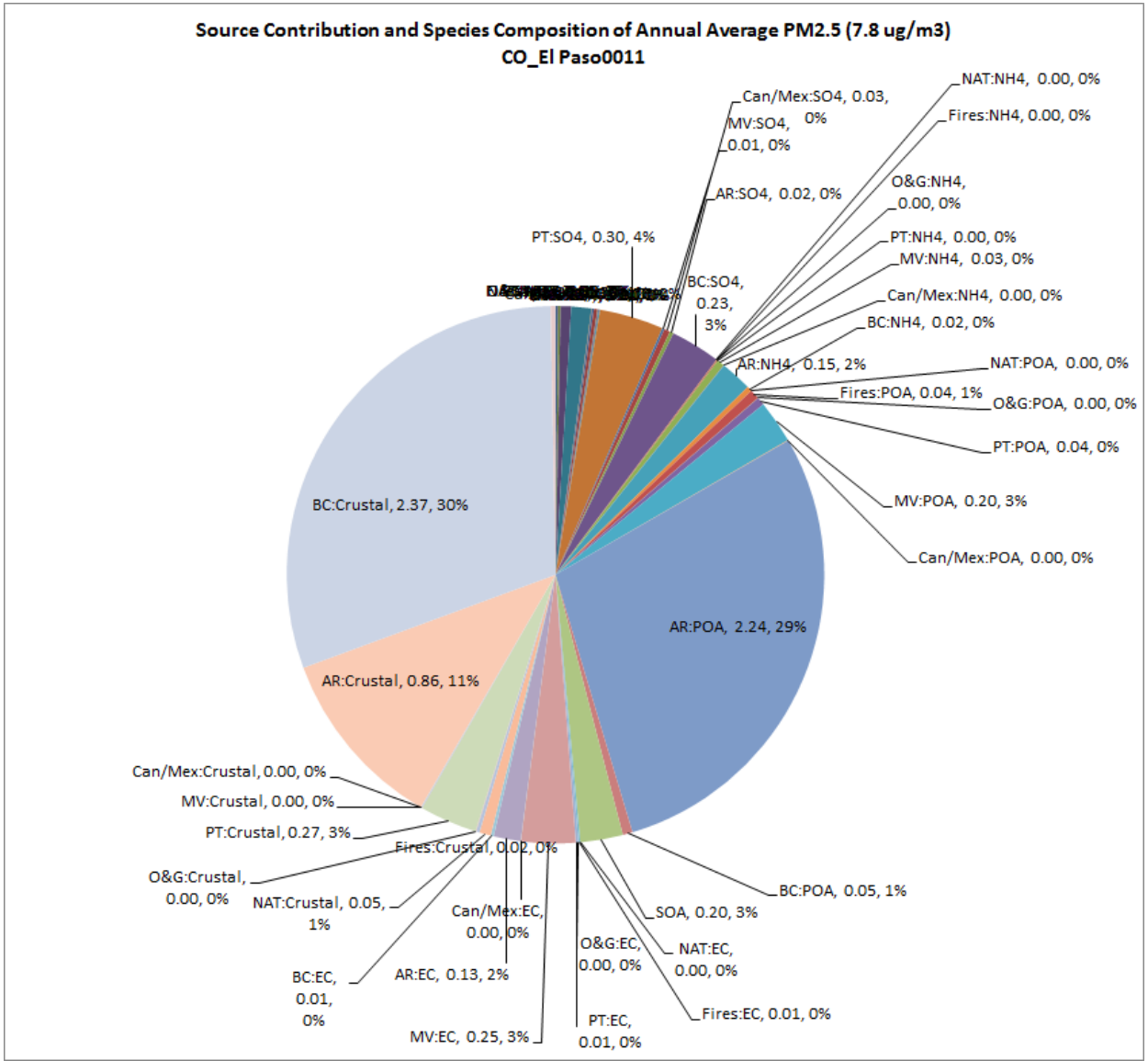
(1) Source Category; (2) PM Species; (3) Mobile Source







Appendix K: Modeled Annual $PM_{2.5}$ at CO_Denver0023 by Category and Species



Appendix·L¶

Source·Category-Specific·Contributions·to·24-Hour·$PM_{2.5}$.Design·Values·at·Monitoring·Sites·in·the·12·km·WESTUS·Domain·using·MATS¶

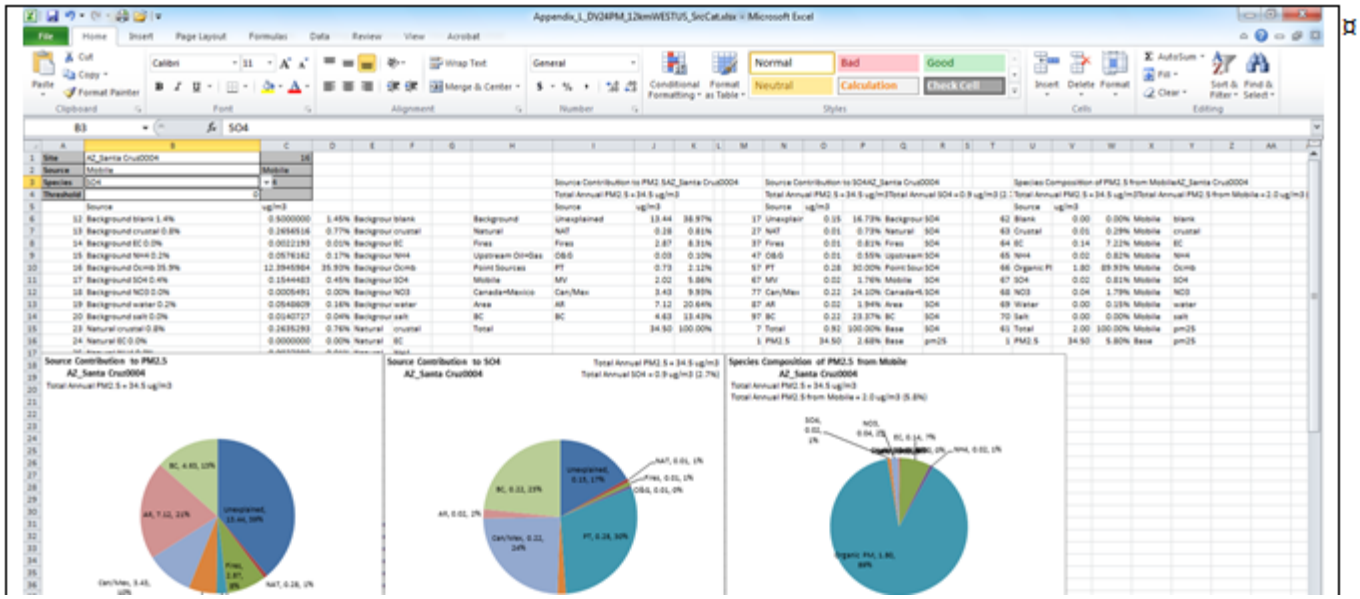
"Appendix_L_DV24PM_12kmWESTUS_SrcCat.xlsx"·(2.0·Mb)¶

Cell·B1·=·Select·Monitor·in·the·12·km·WESTUS·Domain·for·Contributions·to·24-Hour·$PM_{2.5}$·Design·Value·(AZ_SantaCruz0004·in·example)¶

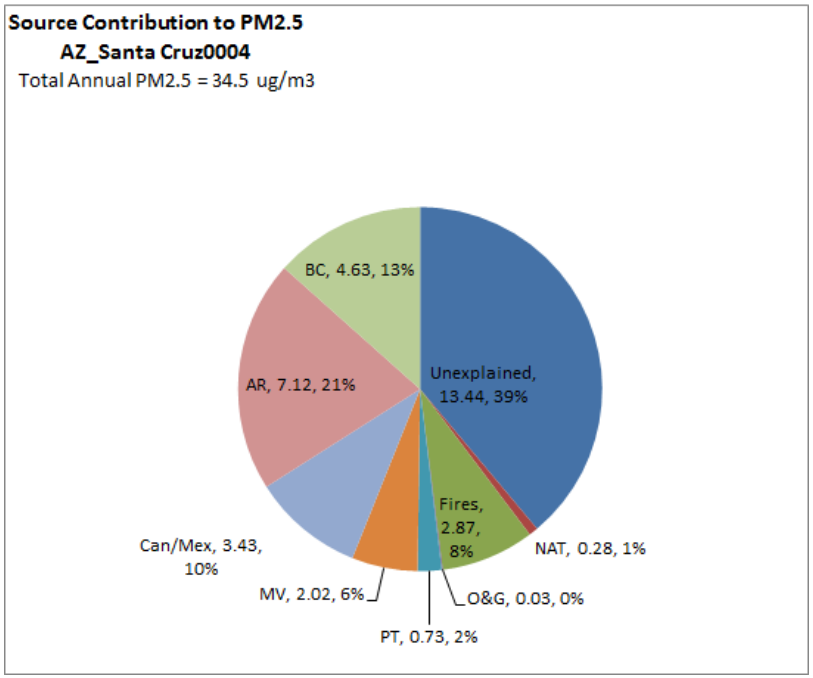
Cell·B2·=·Select·Source·Category·that·will·give·second·plot·of·contributions·for·that·Source·Category·(Mobile·in·example)¶

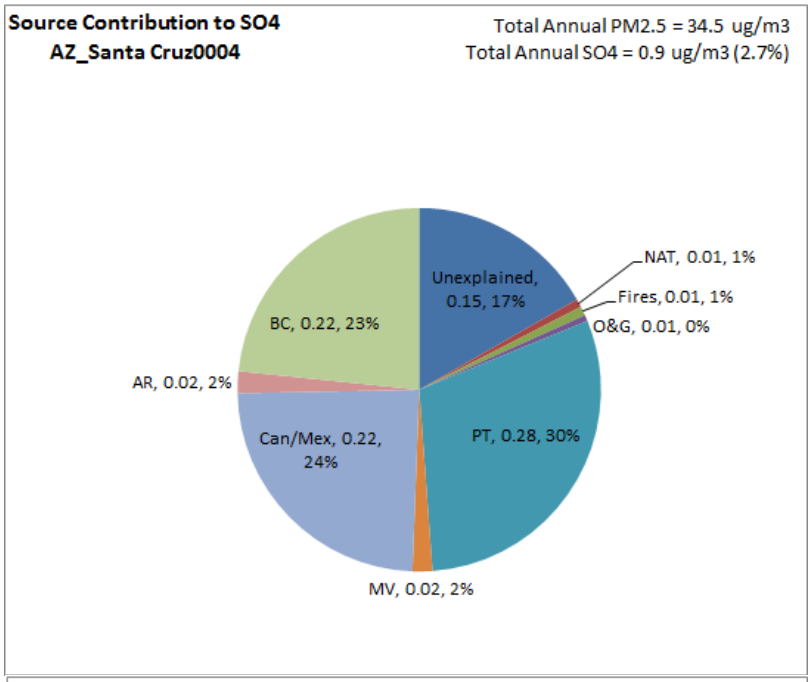
Cell·B3·=·Select·PM·Species·that·will·give·third·plot·of·contributions·for·that·Species·(SO4·in·example)¶

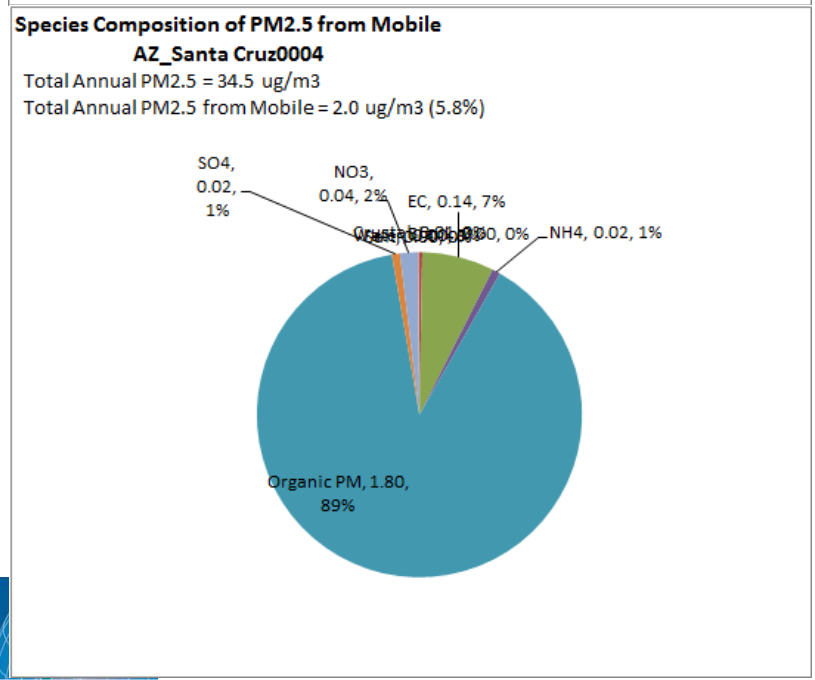
¶



Appendix L: 24-Hour $PM_{2.5}$ DVC Contributions: (1) Total; (2)for SO4; and (3) from Mobile







"Unexplained" very large and almost all associated with Organic Aerosol with SOA insufficient to explain it alone. Likely due to MATS re-ordering days to obtain 98th percentile.

Appendix·M¶

Source·Category-Specific·Contributions·to·Ten·Highest·Modeled·24-Hour·$PM_{2.5}$·Concentrations·(µg/m^3)·at·Monitoring·Sites·in·the·12·km·WESTUS·Domain¶

"Appendix_M_24PM_12kmWESTUS_SrcCat.xlsx"·(4.0·Mb)¶

Cell·B2·=·Select·State·for·Monitoring·Site·(Arizona·in·example)¶

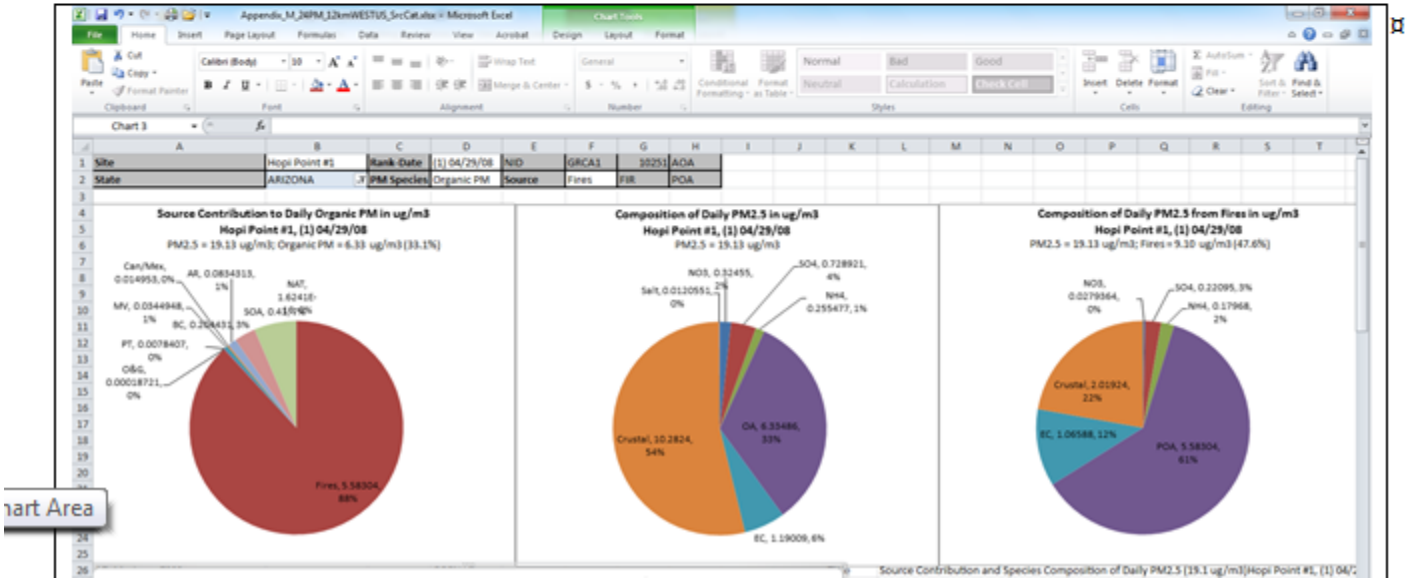
Cell·B1·=·Select·Monitoring·Site·(Hopi·Point·#1·in·example)¶

Cell·D1·=·Selection·One·of·10·Highest·Dates·Rank·#1·on·04/29/08·in·example)¶

Cell·D2·=·Select·PM·Species·for·Separate·Source·Apportionment·Pie·Chart·(Organic·PM·in·example)¶

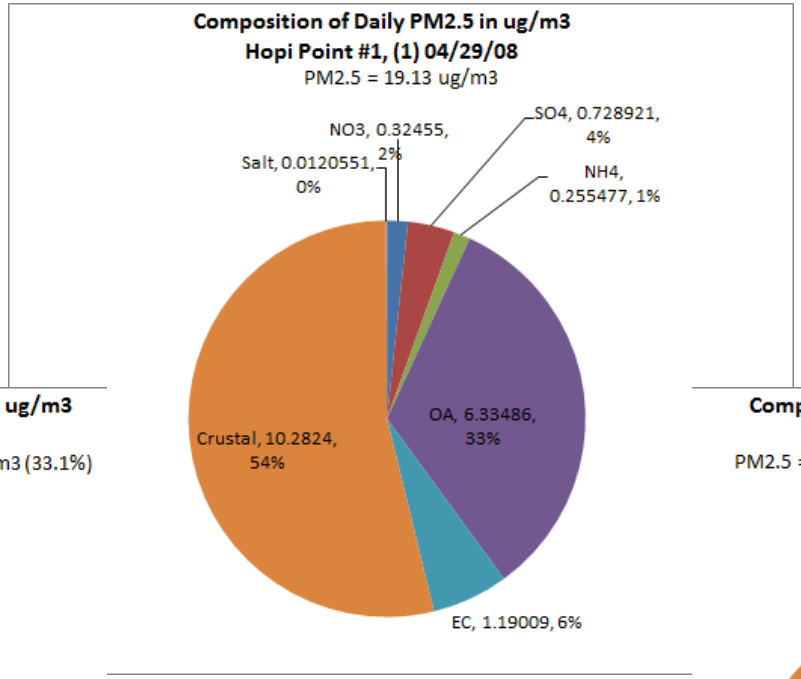
Cell·F2·=·Select·Source·Category·for·Additional·Pie·Chart·(Fires·in·example)¶

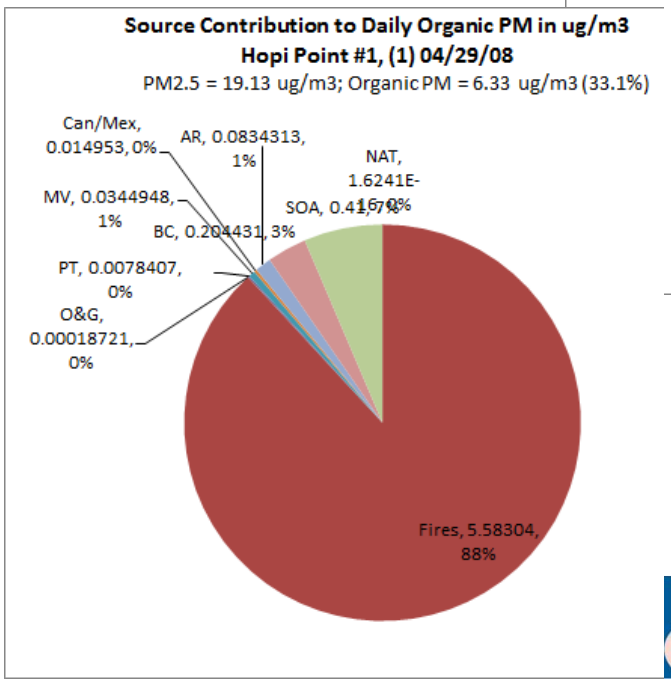
¶

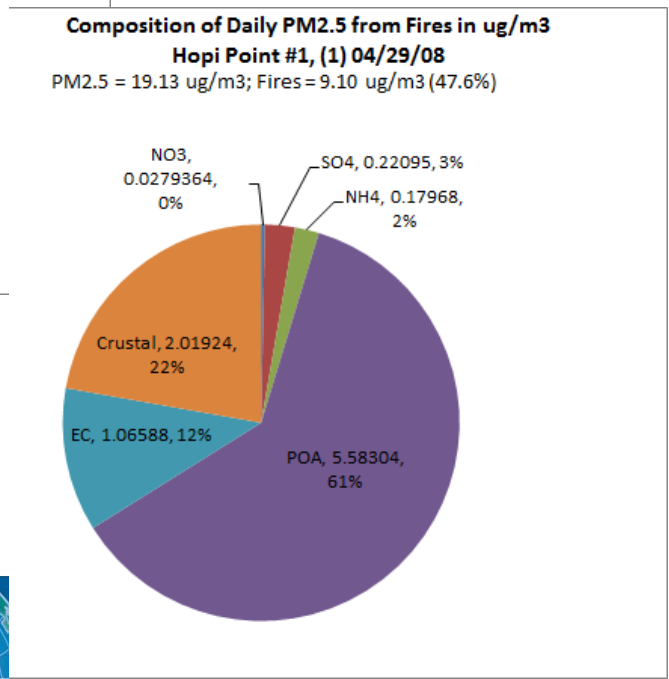


Appendix M: Contributions of 10 Highest Daily $PM_{2.5}$

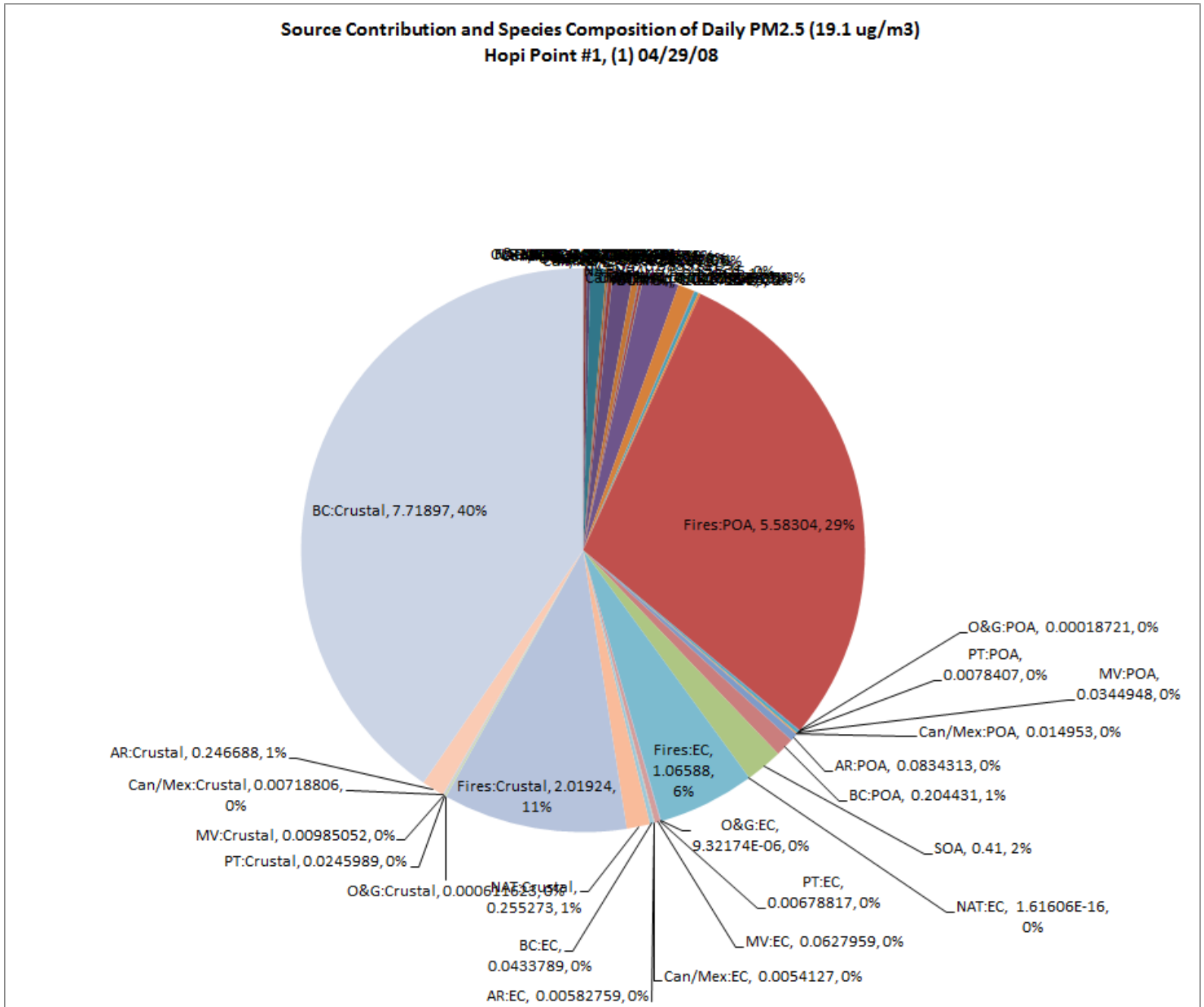
Highest Day at AZ Hopi Point by: (1) PM2.5 Species; (2) PM2.5 Source Categories; and (3)Fires by Species



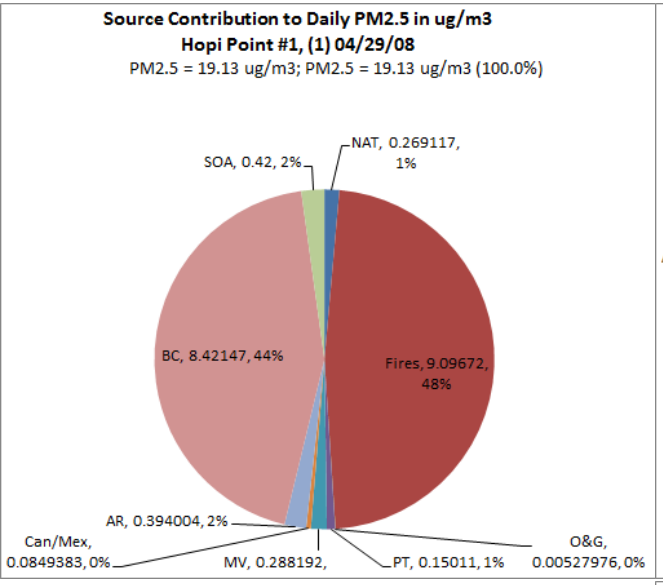


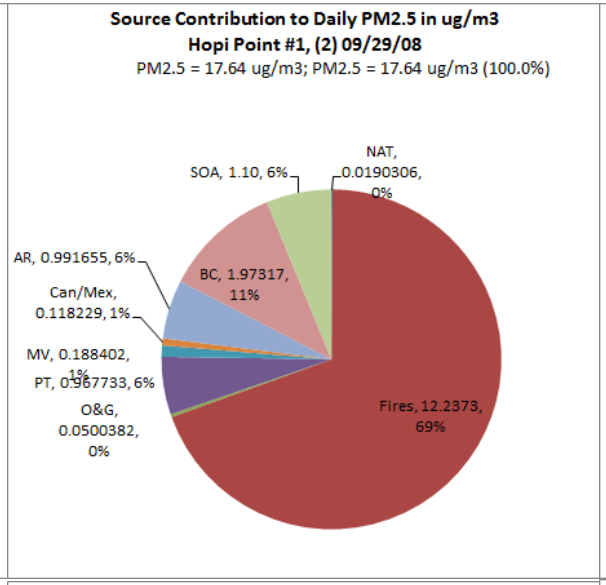


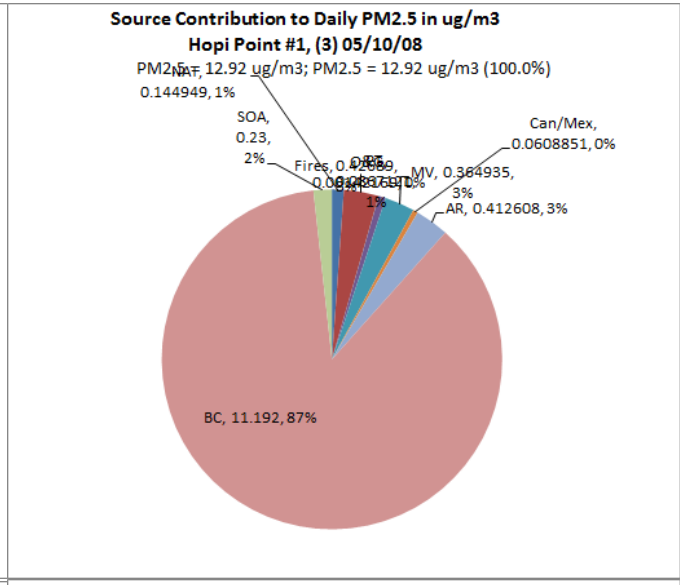
Appendix M: Hopi Point -- Category by Species

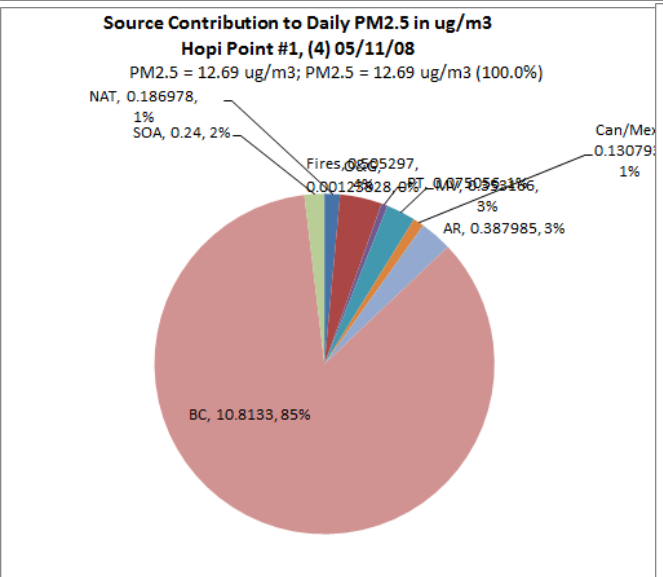


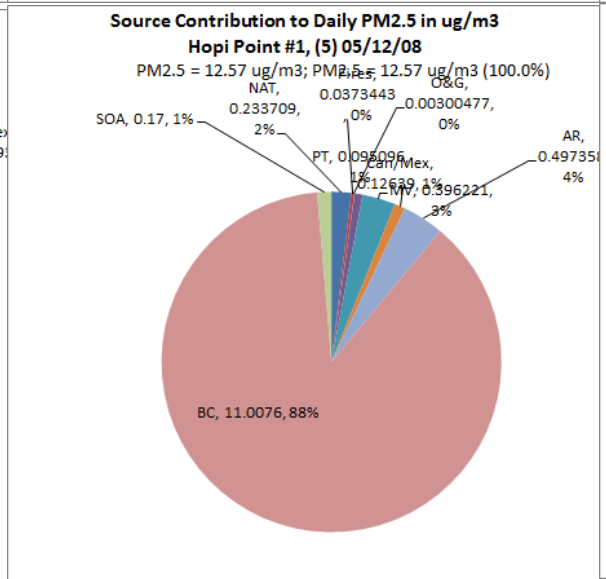
Appendix M: Modeled Six Highest $PM_{2.5}$ Days at Hopi Point: Asian Dust and Fires (or both)

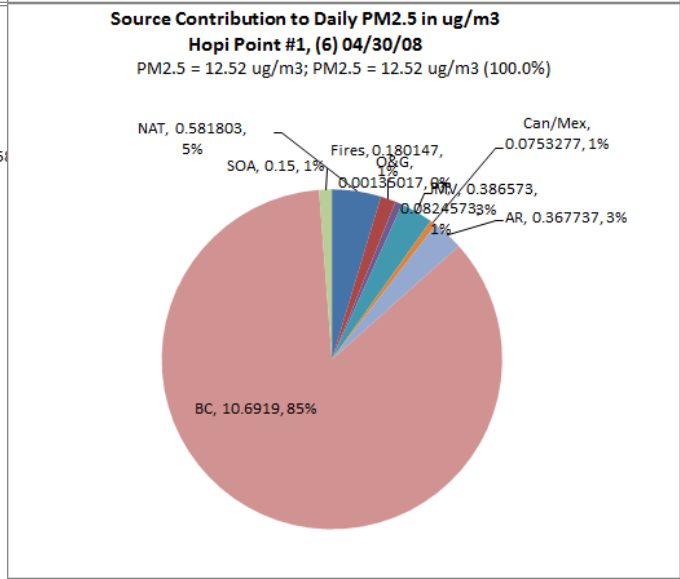












Appendix N

Annual Sulfur and Nitrogen Wet and Dry Deposition at IMPROVE Monitors by Species

First Pie Chart

Cell B1 = Select IMPROVE Monitoring Site (ROMO1 in example)

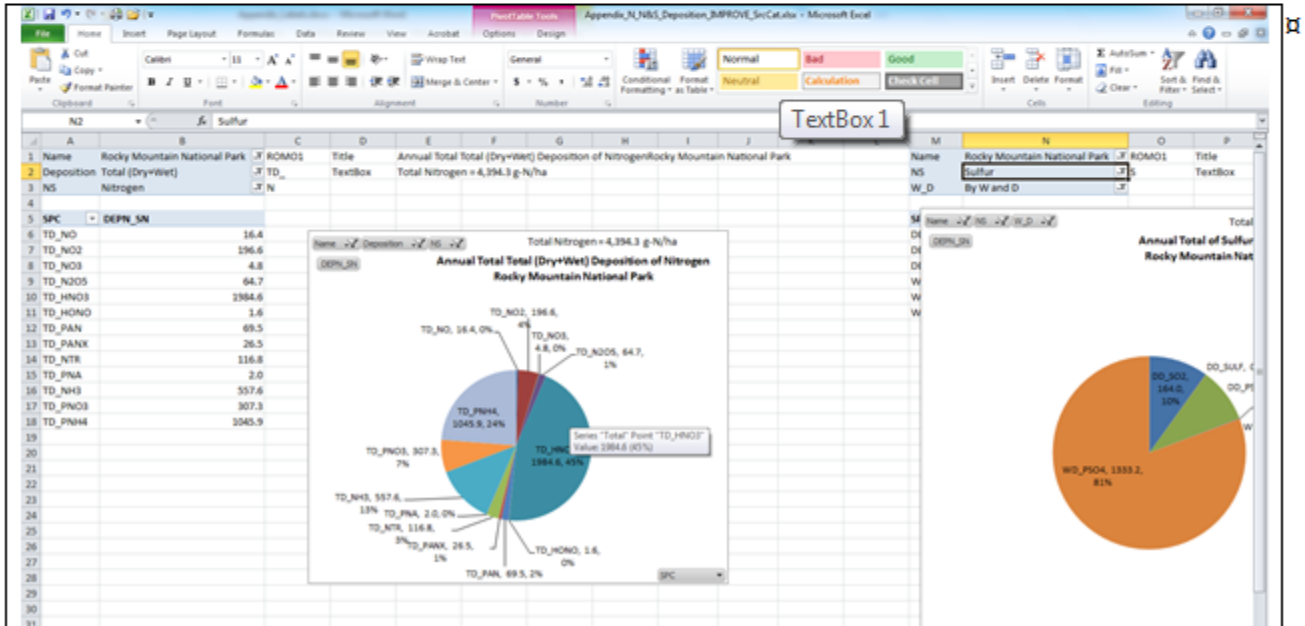
Cell B2: Select whether want Wet, Dry or Total Deposition (Total in example)

Second Pie Chart

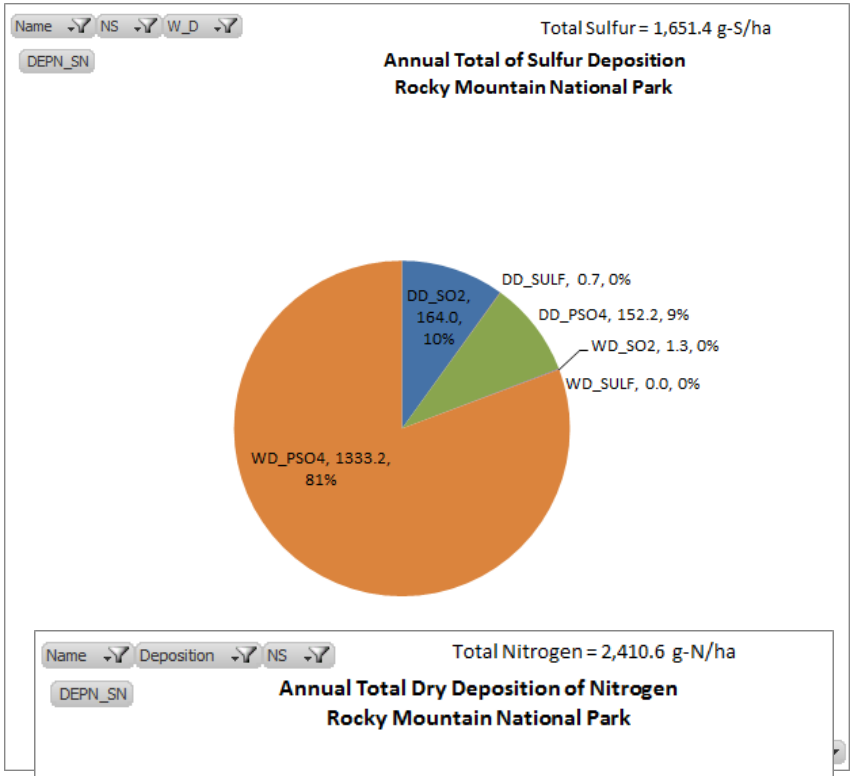
Cell D1 = Select IMPROVE Monitoring Site (ROMO1 in example)

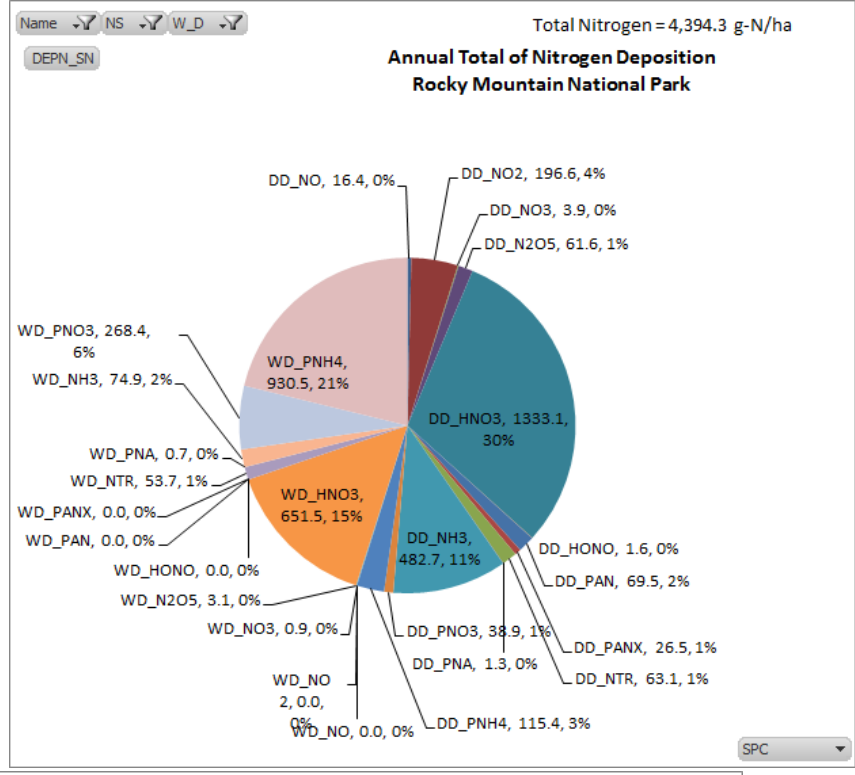
Cell D2 = Select whether want Sulfur or Nitrogen (Sulfur in example)

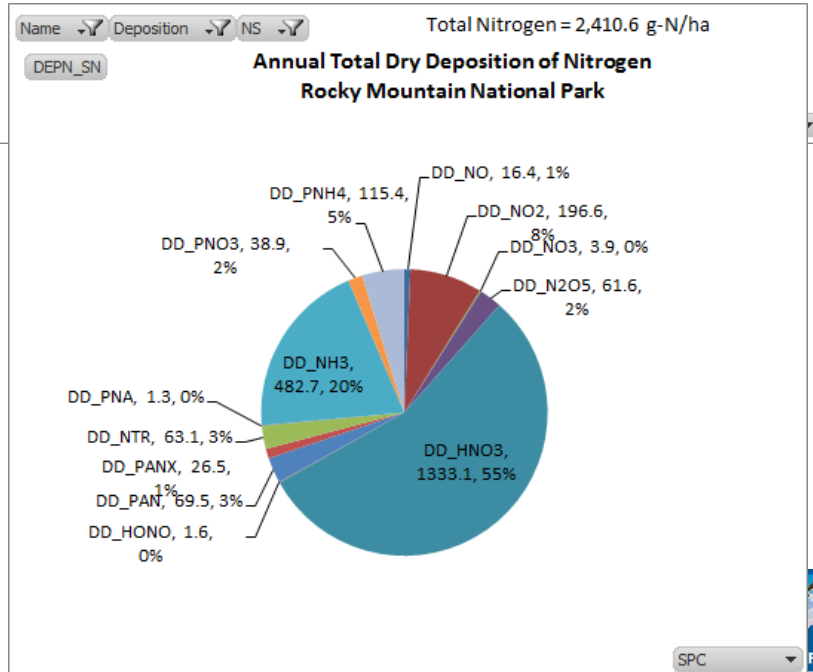
Cell D3 = Select whether want by Wet and Dry or by Total Deposition

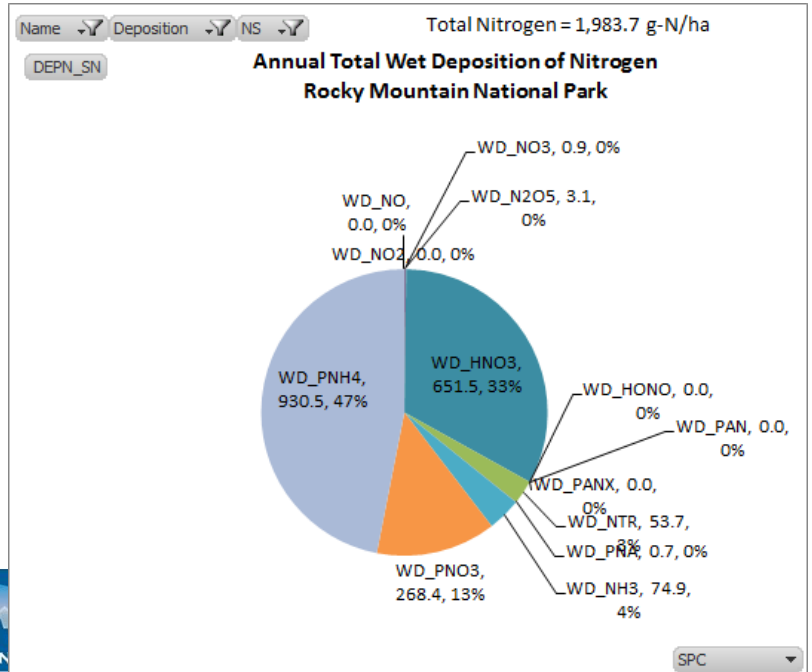


App M: Dep at ROMO









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¶

"Appendix_O_Vis_FLAG_IMPROVE_State-xlsm"·(3.0·Mb)¶

Cell·B1·=·Path·where·site-specific·.crv·files·are·stored¶

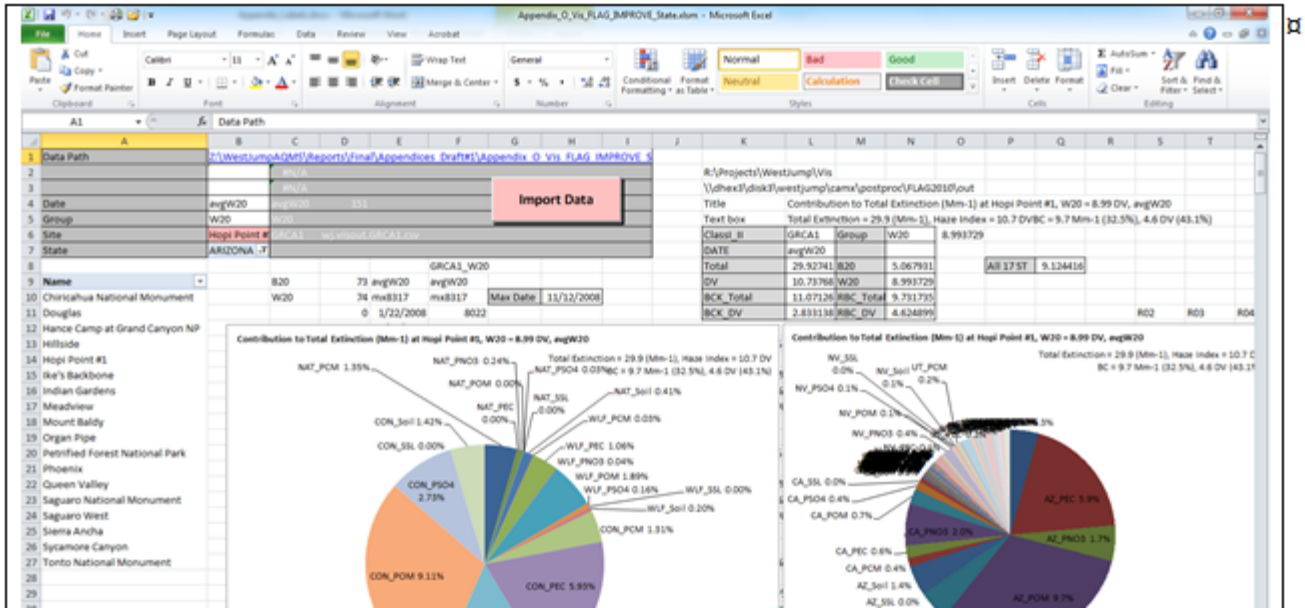
Cell·B7·=·State·for·monitor·desired·(Arizona·in·example)¶

Cell·B6·=·Monitoring·Site·in·State·(Hopi·Point·in·example,·GRCA)¶

Once·a·new·monitoring·site·is·selected·data·needs·to·be·imported·through·the·pink·"Import·Data"·button¶

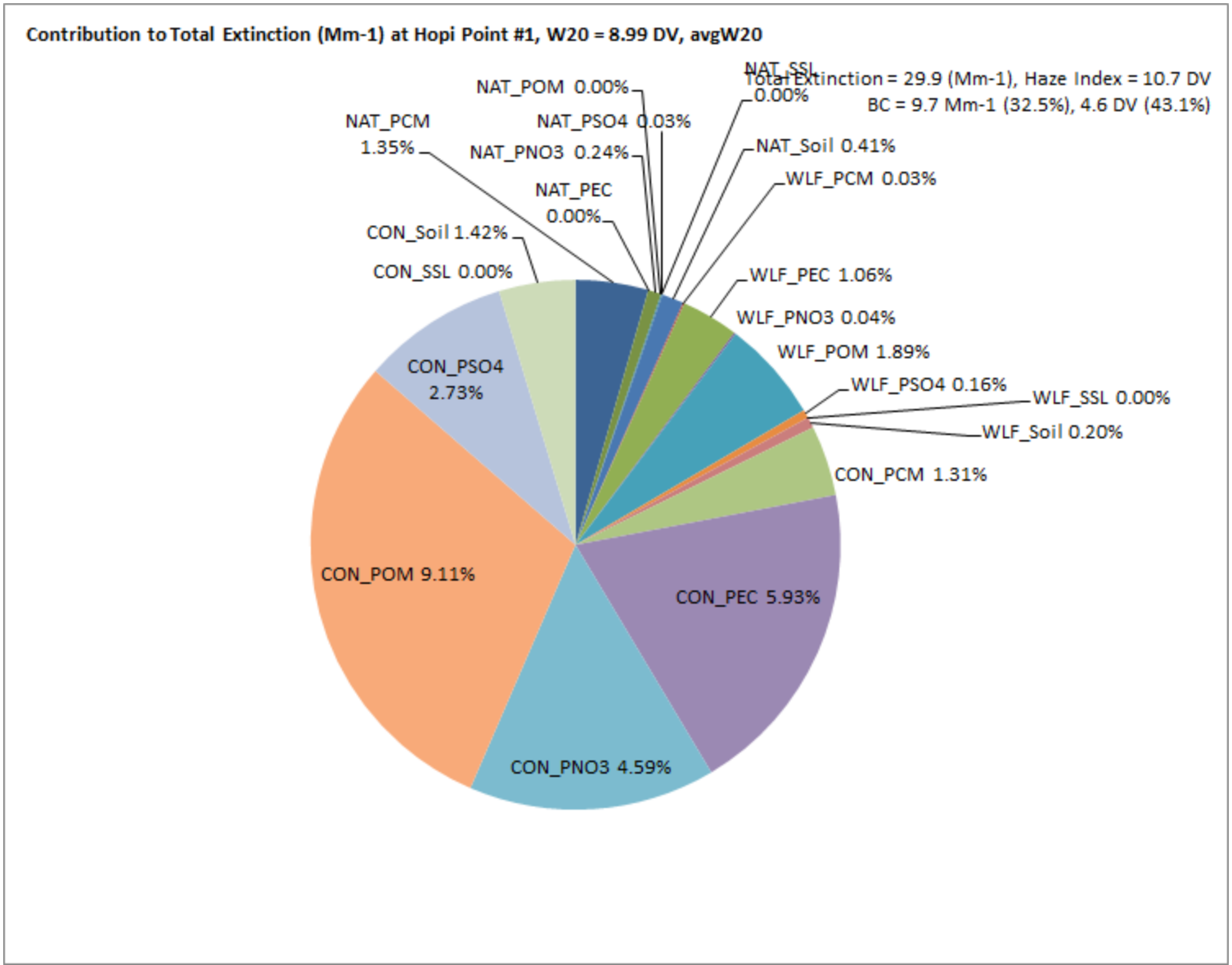
Cell·B5·=·Select·whether·want·W20·or·B20·days·(W20·in·example)¶

Cell·B4·=·Select·individual·day·or·average·for·display·(avgW20·in·example)¶

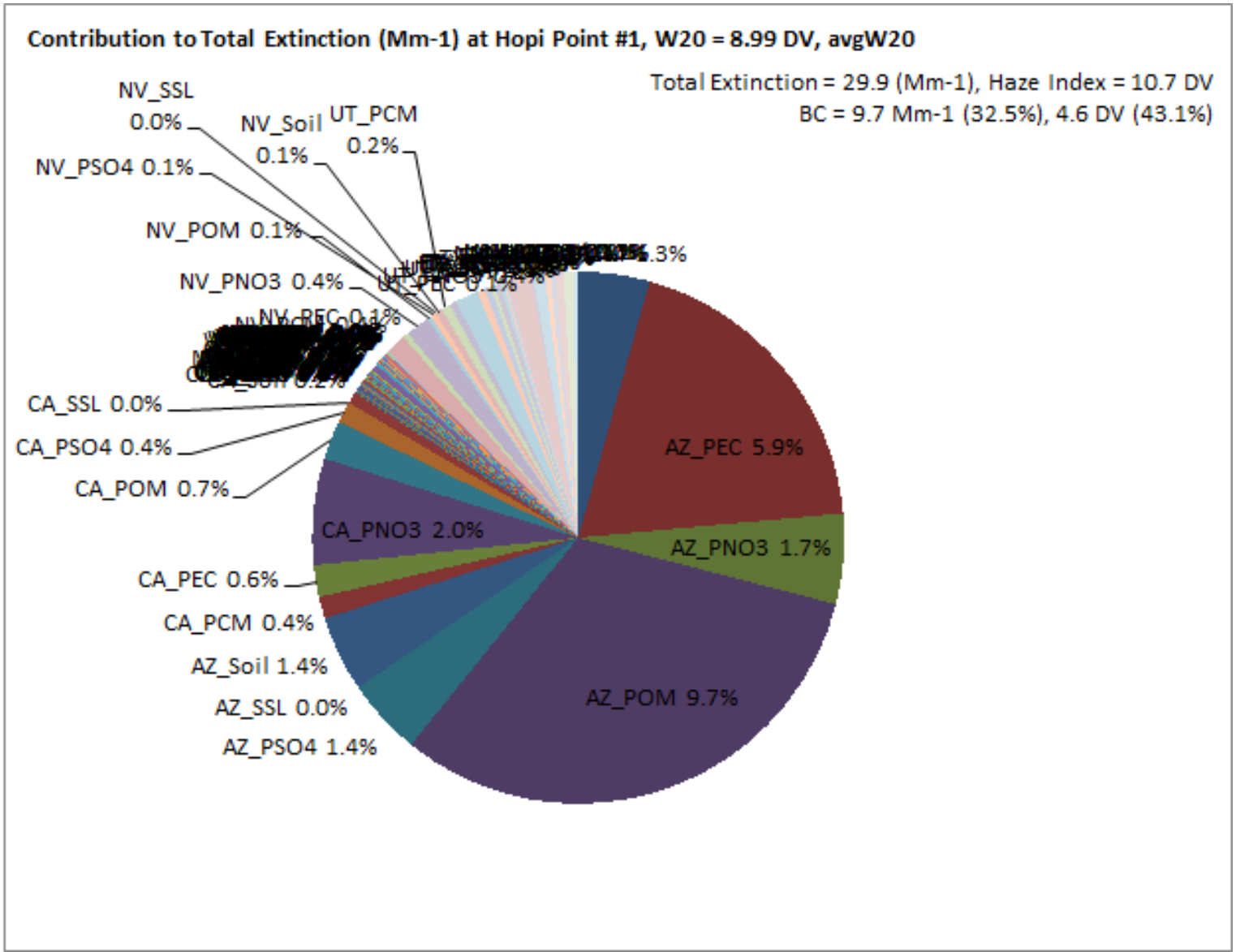


- Pie Chart displays are just for the 17 western states
- Total extinction without Rayleigh is in cell L8 (29.9 Mm^{-1} in example)
- Background Sources (i.e., EUSA, Mexico, Canada, Off-Shore and SOA) extinction is in cell L10 (11.1 Mm^{-1})
- Boundary Condition (BC) contribution is in plots (9.7 Mm^{-1} in example)
- Pie Chart breaks down 17 state contributions to extinction either by Source Category and Species (left plot) or by State and Species (right plot). Three Source Categories are used:
  - NAT = Natural Emissions (Biogenic, Lightning, Sea Salt and WBD)
  - WLF = Wild Fires
  - CON = Controllable Emissions (Anthropogenic and Rx and Ag fires)

Appendix O: Hopi Point AvgW20 SrcCat x Species

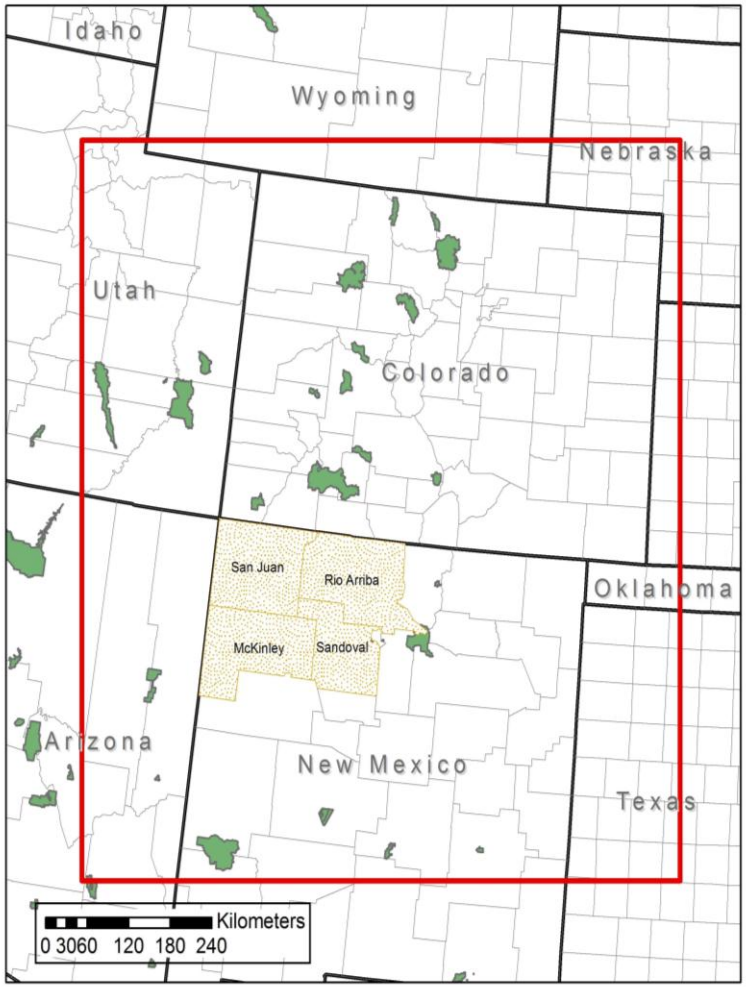


Appendix O: Hopi Point AvgW20 State x Species



Colorado Air Resource Management Modeling Study (CARMMS)

- Stand-alone 4 km database originally designed to assess air quality and AQRV impacts due to BLM oil and gas and other development activities within BLM Western Colorado Field Offices (e.g., GJFO and UFO)
- Being expanded to other BLM areas:
  - Eastern Colorado (RGFO)
  - Northwest New Mexico (FFO Mancos Shale)



WestJumpAQMS CARMMS Development Status

- CAMx 2008 base case using CARMMS 4 km domain has been completed
  - Model performance evaluation for ozone, total PM2.5, speciated PM2.5, SO2, HNO3, NOX, NOY, NMOC and wet deposition of SO4, NO3 and NH4
  - Chapter within WestJumpAQMS Final Report
- CARMMS CAMx 2008 4 km modeling database has been handed off to BLM contractor

WestJumpAQMS Lessons Learned

- Emissions
  - National Emissions Inventory
  - Oil and Gas
  - Mobile
  - Point
  - Ammonia
  - Fires
  - Biogenic
- Emissions Modeling
  - Separate streams
  - County vs. tribal IDs
  - Emissions merging
  - QA/QC
- Meteorological Modeling
  - Modeling domains
  - Physics options
  - QA/QC
- Source Apportionment Modeling
  - Computational requirements
  - Benchmarking
  - Use of MATS for PM2.5
- Electronic/Web-Based Displays
  - Feasibility
  - Usability

WestJumpAQMS Next Steps

- Complete Draft Final Report with Electronic Appendices by end of August 2013 and Post on WRAP Website
  - Likely posted Tues Sep 3, 2013 due to Labor Day Weekend
  - Draft Final Report (PDF) and 15 Electronic Appendices (xls & zip)
- Two week review of Draft Final Report
  - Comments by September 17, 2013
- Finalize report in a week (September 24, 2013)
- Transfer all databases and modeling results to Three-State Data Warehouse (3SDW)
  - CMAQ and CAMx model comparison on 3SDW
- Two additional Technical Memorandums in preparation:
  - Emissions Memorandum No. 13 on Modeling Parameters to include WRAP Phase III VOC speciation profiles for oil and gas sources (from comments)
  - Memorandum on improvements in emissions modeling for ammonia emissions