Successful Wildfire Ozone Exceptional Events Demonstrations in Washoe County

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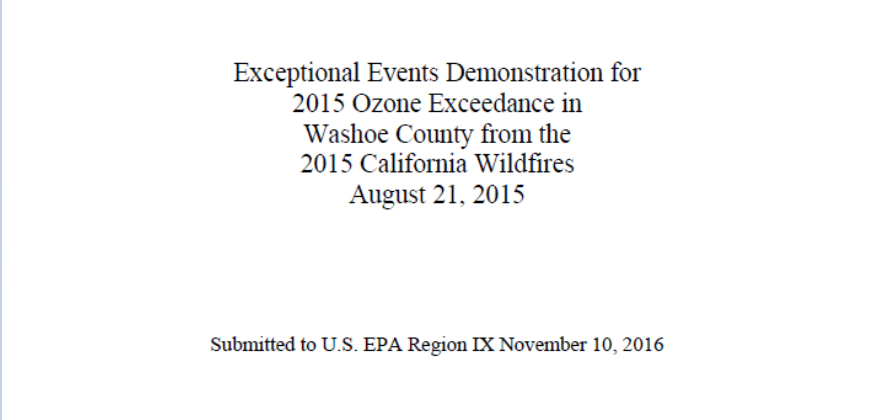
Washoe County Health District, Air Quality Management Division

2018 National Air Quality Conference

January 25, 2018

2015 and 2016 Wildfire Ozone Exceptional Events Demonstrations

- 2015 Wildfire Ozone
  - Submitted November 2016
    - August 21, 2015
  - Addendum March 2017
    - August 18-19, 2015
- 2016 Wildfire Ozone
  - April 2017
    - July 2-4, 2016
- 2016 Revisions EER
- Regulatory Significance
  - 2015 Ozone NAAQS Designations



Exceptional Events Demonstration for
2015 Ozone Exceedance in
Washoe County from the
2015 California Wildfires
August 21, 2015

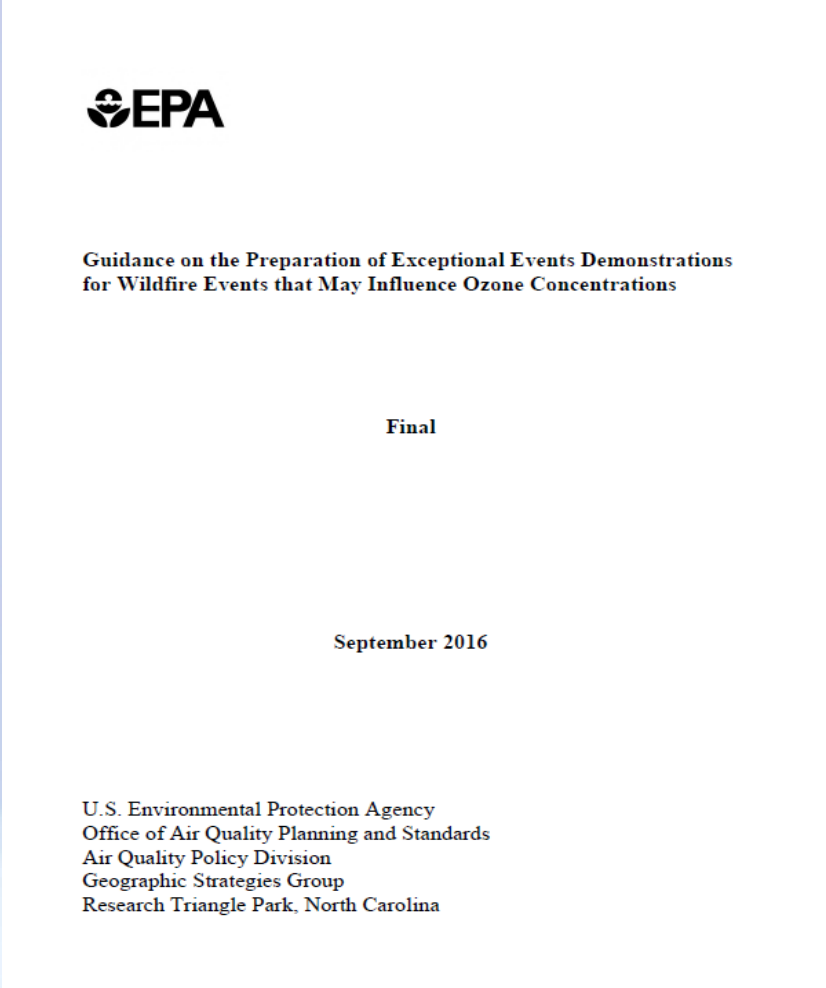
Submitted to U.S. EPA Region IX November 10, 2016

Requesting Exclusion of Data from 2015 and 2016 Events

Date of Event	Type of Event	NAAQS Standard	Site Name	Monitor Concentration
8/18/2015	Wildfires	8- Hour Ozone	Reno3	0.075ppm
8/19/2015	Wildfires	8- Hour Ozone	Reno3	0.073ppm
8/21/2015	Wildfires	8- Hour Ozone	Reno3	0.073ppm
7/2/2016	Wildfires	8- Hour Ozone	Reno3	0.073ppm
7/3/2016	Wildfires	8- Hour Ozone	Reno3	0.073ppm
7/4/2016	Wildfires	8- Hour Ozone	Reno3	0.073ppm

Exceptional Events Demonstration Requirements

- **Narrative Conceptual Model**
  - Regional Description
  - Non-Event Ozone Formation
  - Exceptional Event Summary
- **Clear Causal Relationship**
  - Tiered Analysis
- Natural Event
- Not Reasonably Controllable or Preventable
- Conclusions and Recommendations



EPA

Guidance on the Preparation of Exceptional Events Demonstrations for Wildfire Events that May Influence Ozone Concentrations

Final

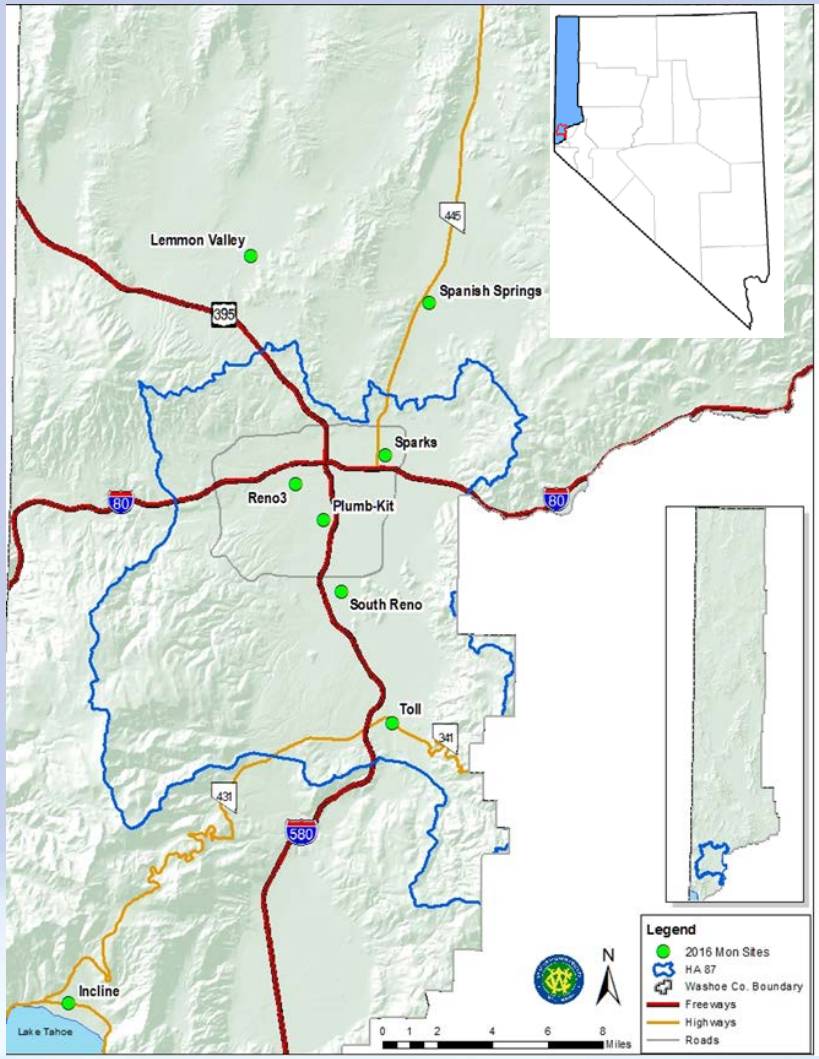
September 2016

U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
Air Quality Policy Division
Geographic Strategies Group
Research Triangle Park, North Carolina

Narrative Conceptual Model

- Regional Description
- Overview of Monitoring Network
- Non-Event Historical O_3 Formation
- Exceptional Event Summary
  - Daily Event Summaries
  - Event Related Concentrations
  - Meteorological Conditions
  - Media Coverage

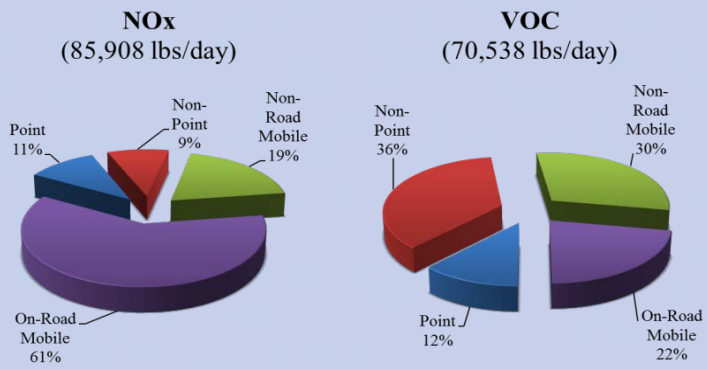
Regional Description and Overview of Monitoring Network



- Washoe County
  - ~6,000 Square Miles
  - 440,000 Population
  - Truckee Meadows (HA87)
  - Elevation 4,400’
  - Surrounding Mountains
  - Summer O_3, Winter $PM_{2.5}$
- Overview of Network
  - 8 SLAMS
    - NCore
  - Speciation Trends Network

Non-Event Historical Summertime Ozone Formation

NOx and VOC Typical Summertime Emissions



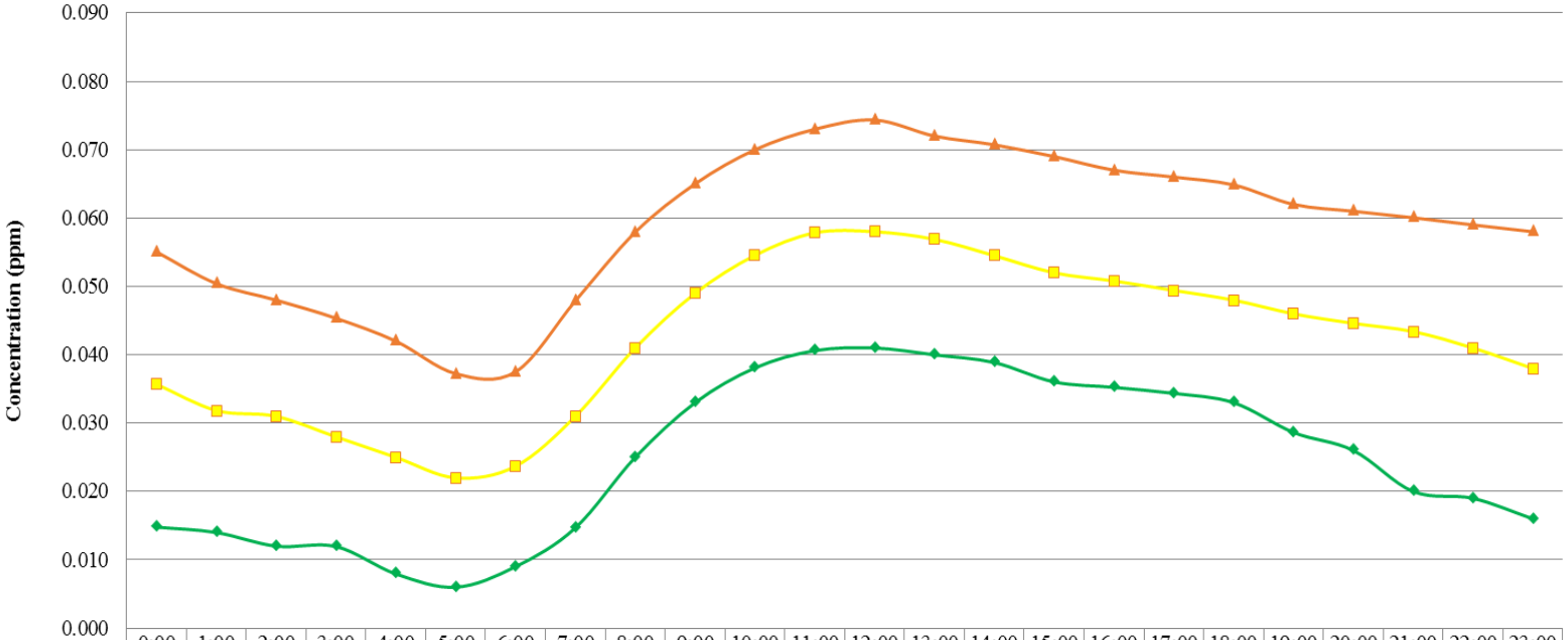
8-hour Summertime O_3 Concentrations at Reno3 (2011-2016)

Percentile	Concentration (ppm)
100	0.075
99	0.073
98	0.072
95	0.069
90	0.067
50	0.057

- June through August
  - Peak VMT
  - Increased Wildfires
- NOx and VOCs
  - Mobile Sources
- Historical 8-Hour O_3
  - Excluding 2015 Events

Typical 1-Hour Summertime Diurnal Ozone Pattern

June to August (2011-2015) at Reno3



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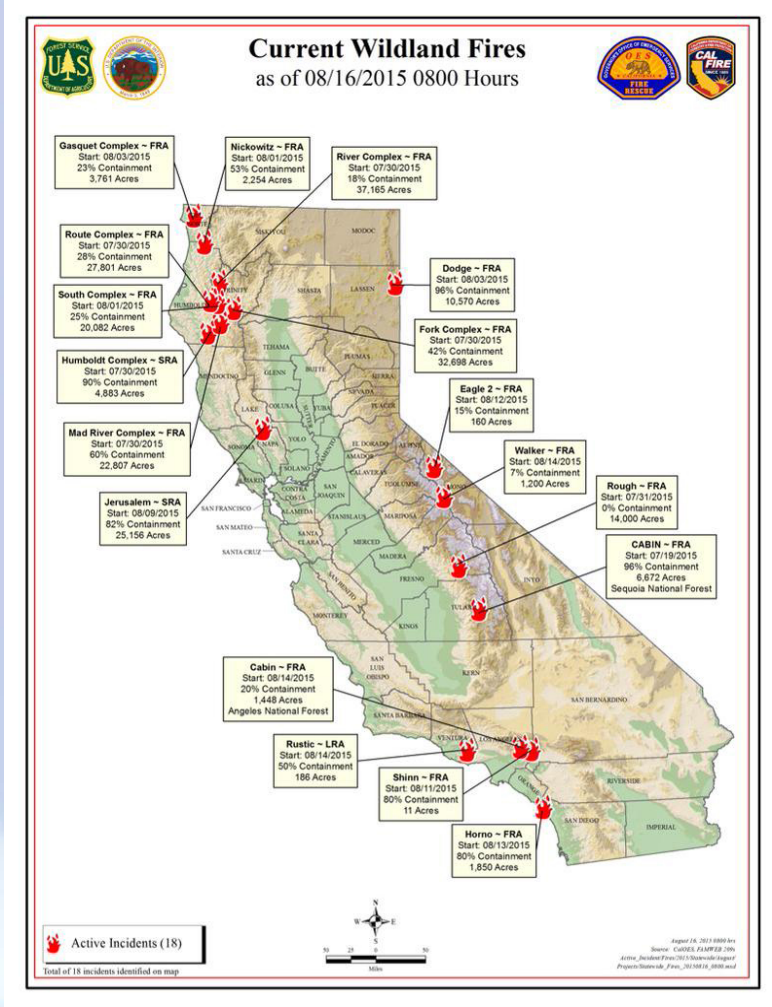
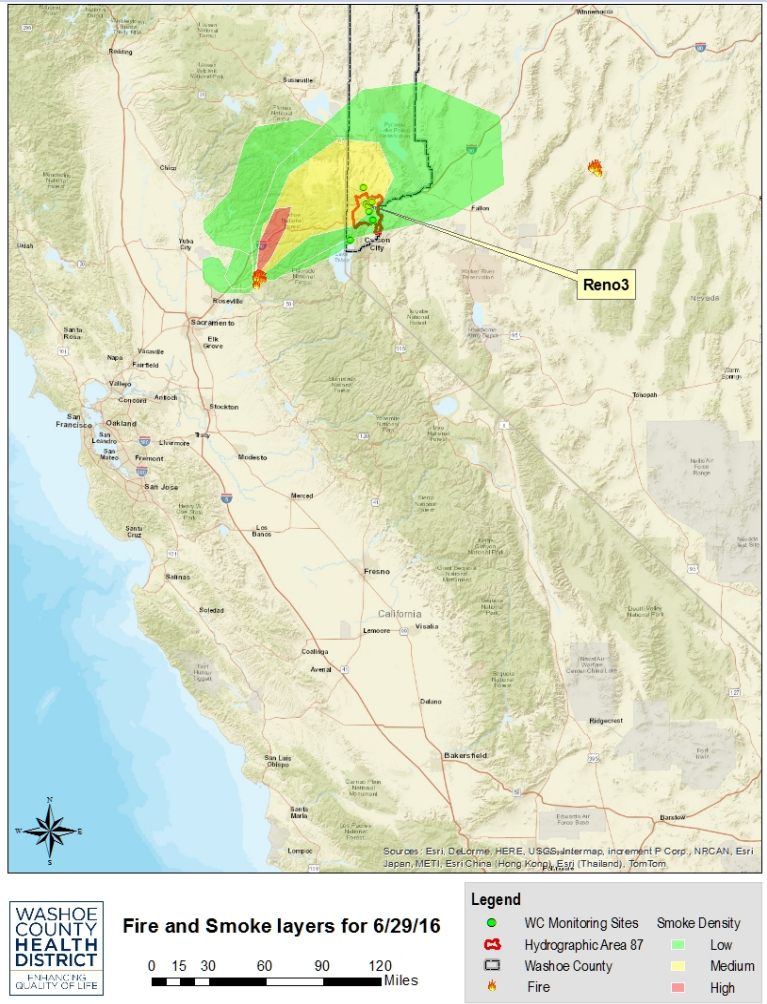
95%ile	0.055	0.050	0.048	0.045	0.042	0.037	0.038	0.048	0.058	0.065	0.070	0.073	0.074	0.072	0.071	0.069	0.067	0.066	0.065	0.062	0.061	0.060	0.059	0.058
50%ile	0.036	0.032	0.031	0.028	0.025	0.022	0.024	0.031	0.041	0.049	0.055	0.058	0.058	0.057	0.055	0.052	0.051	0.049	0.048	0.046	0.045	0.043	0.041	0.038
5%ile	0.015	0.014	0.012	0.012	0.008	0.006	0.009	0.015	0.025	0.033	0.038	0.041	0.041	0.040	0.039	0.036	0.035	0.034	0.033	0.029	0.026	0.020	0.019	0.016

Exceptional Event Summaries: 2015 Event Summary



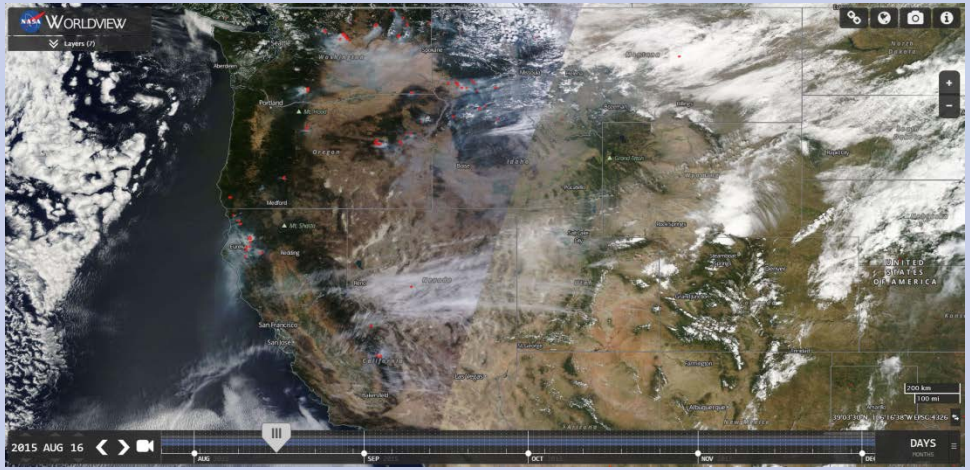
- 2015 California Wildfire Season
  - Above 10-year Average
  - 8,745 Fires
  - 893,362 Acres
- Complex Fires/OR and WA
- August 16 – 21, 2015
  - 9 Ozone Exceedances
- August 18th, 19th and 21st
  - Exclusion of 3 O_3 Exceedances
  - Reno3 Monitoring Site

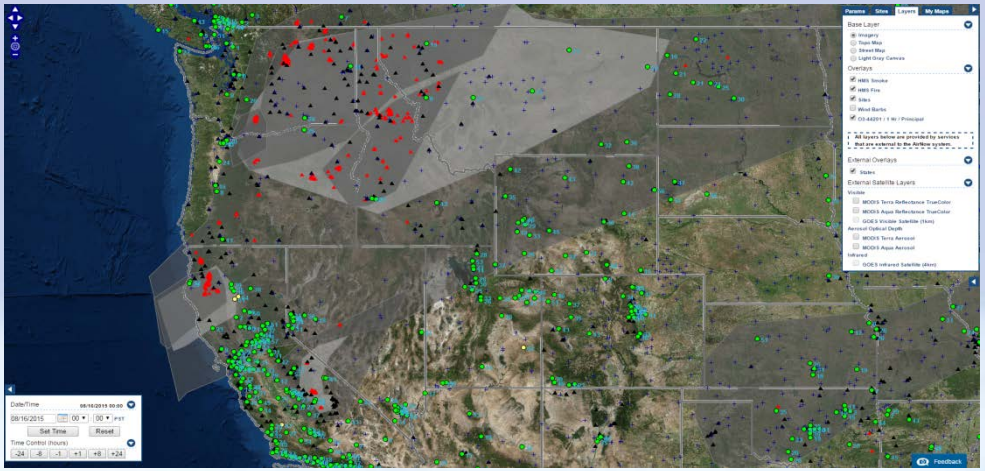
2016 Event Summary

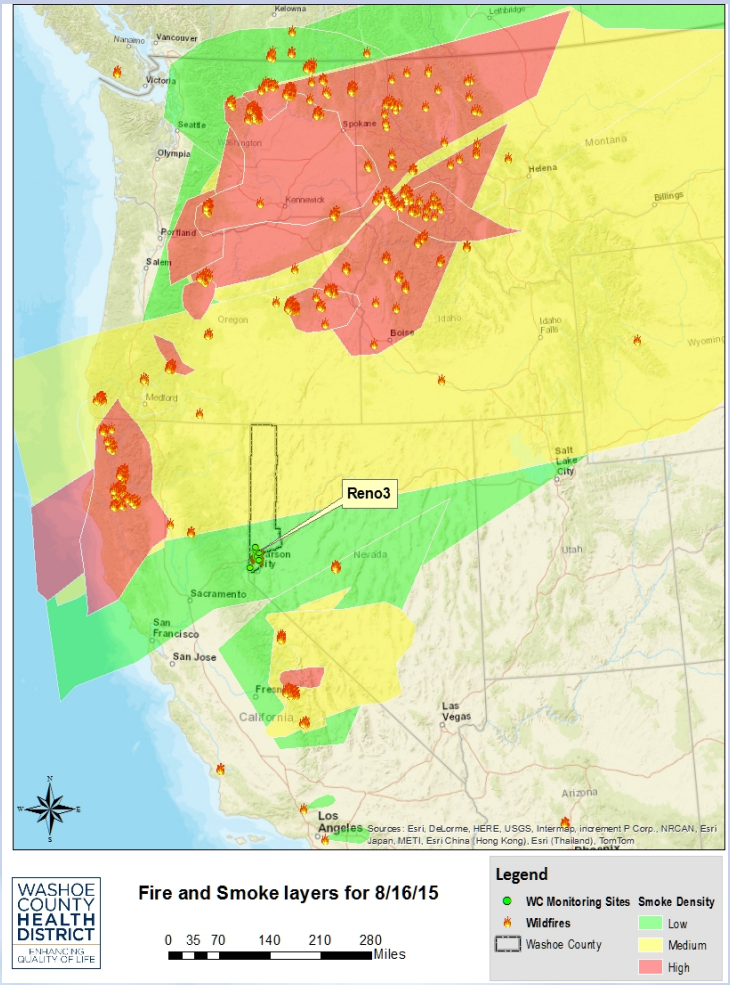


- Trailhead Fire
  - Started June 28, 2016
  - 5,646 Acres
- June 29 to July 4, 2016
  - 3 Ozone Exceedances
- July 2nd, 3rd, and 4th
  - Exclusion of 3 O_3 Exceedances
  - Reno3 Monitoring Site

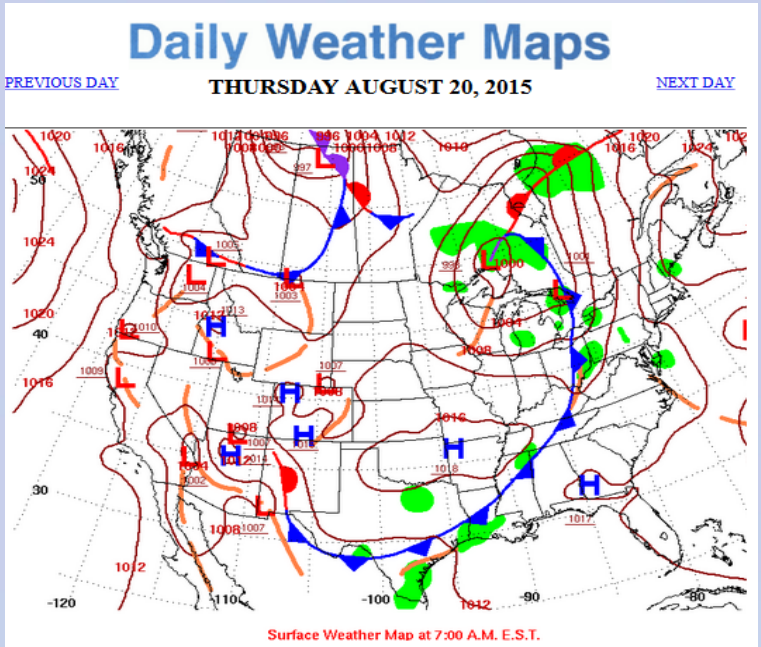
Daily Event Summaries

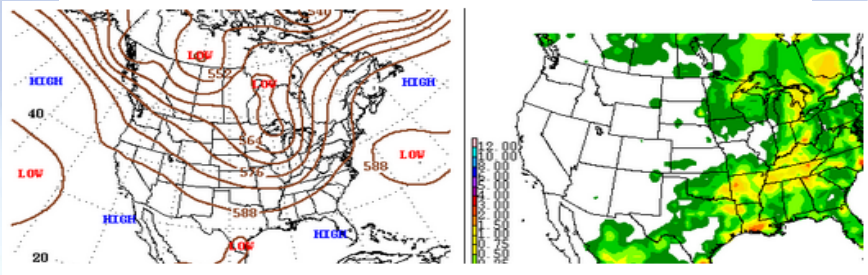






Meteorological Conditions

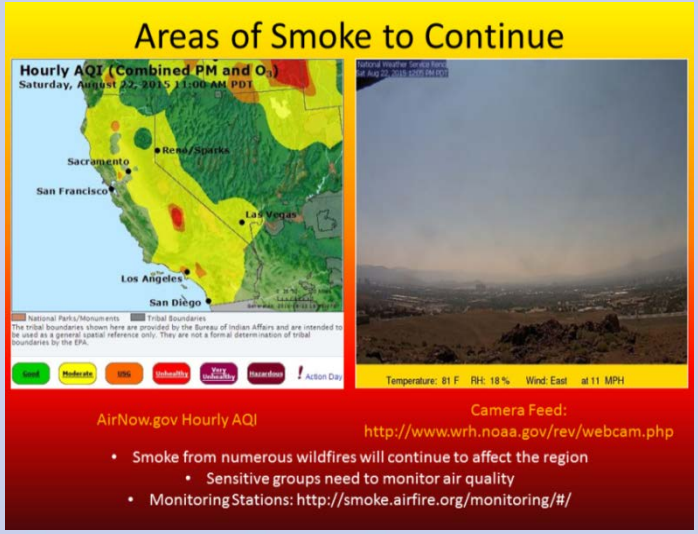




Event Weather Summary

Parameter	08/16	08/18	08/19	08/21	08/25
O_3					
8-hour maximum (ppb)	0.061	0.075	0.073	0.073	0.049
Maximum Temperature					
Observed (°F)	98	98	98	95	96
Normal (°F)	91	90	90	90	89
Wind Speed					
24-hour Observed (mph)	5.8	4.9	5.7	6.5	6.9
24-hour Normal (mph)	6.6	6.6	6.6	6.6	6.6
2-min Observed (mph)	26	18	22	22	23

Media Coverage



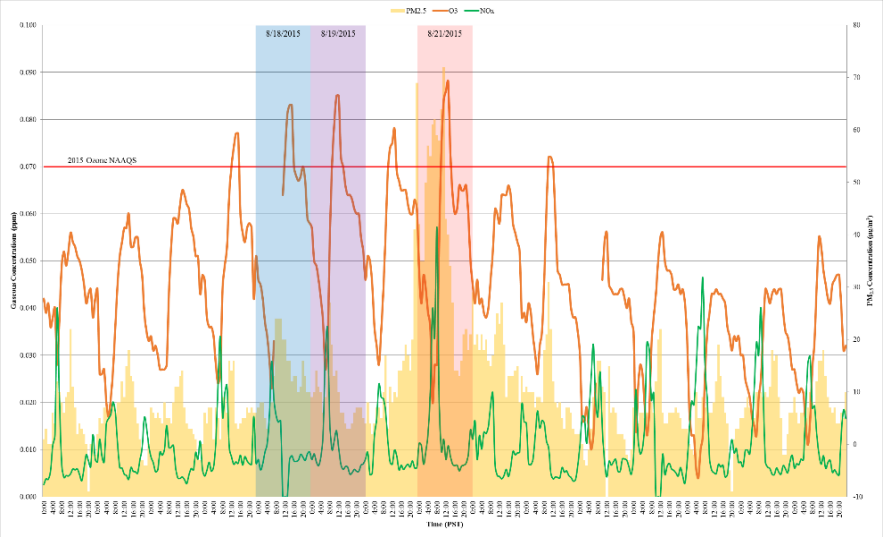
- Demonstrate Timely and Consistent Information
  - NWS and Local Media
  - AirNow AQI
  - Enviroflash Alerts
  - Air Quality Hotline
- Current AQI
- Areas of Smoke Impacts
- Reduce Exposure

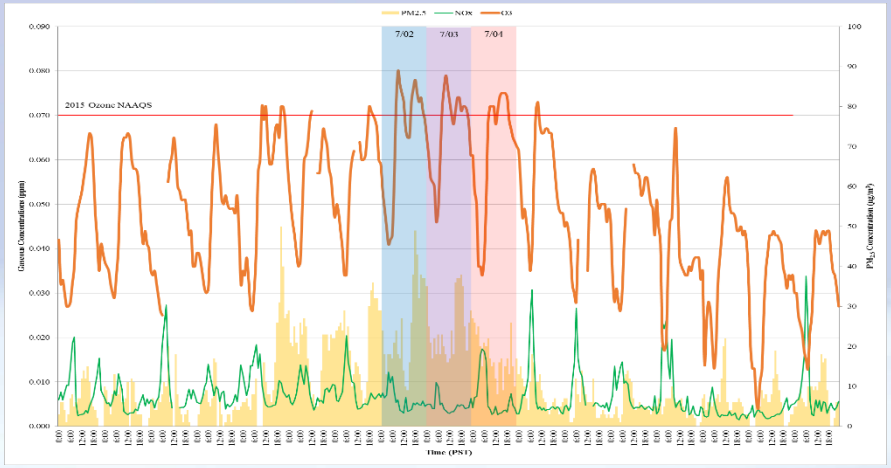
Clear Causal Relationship

- Tier 3 Demonstration
  - Event Related Concentrations
  - Q/D (Emissions/Distance)
  - Historical Concentrations
  - Trajectory Analysis
  - $PM_{2.5}$ Analysis
- Additional Information
  - Area Forecast Discussions
  - Smoke Text Products

Event Related Concentrations

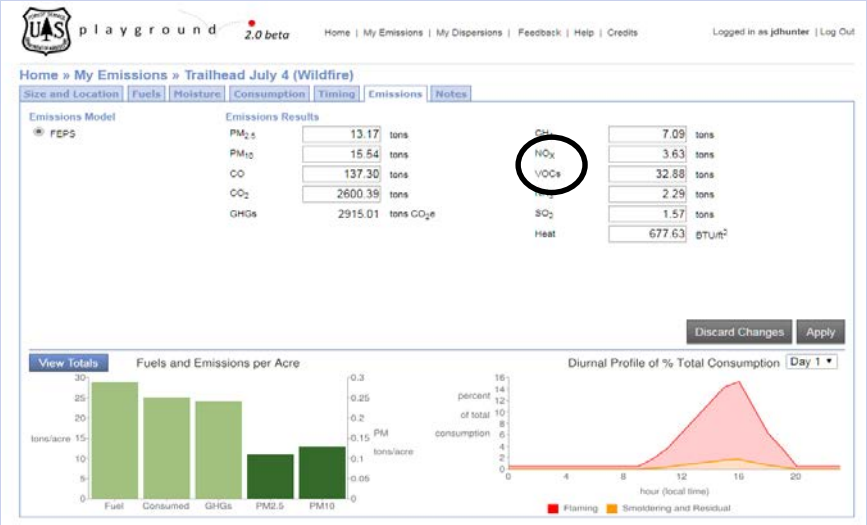
Reno3 O_3, NOx, and $PM_{2.5}$ Hourly Concentrations





- O_3, $PM_{2.5}$ and NOx Hourly Concentration Comparisons
- Before and After Event
- Elevated on Event Days
- NOx from Smoke Increased O_3

Emissions/Distance Calculations (Q/D) July 4, 2016

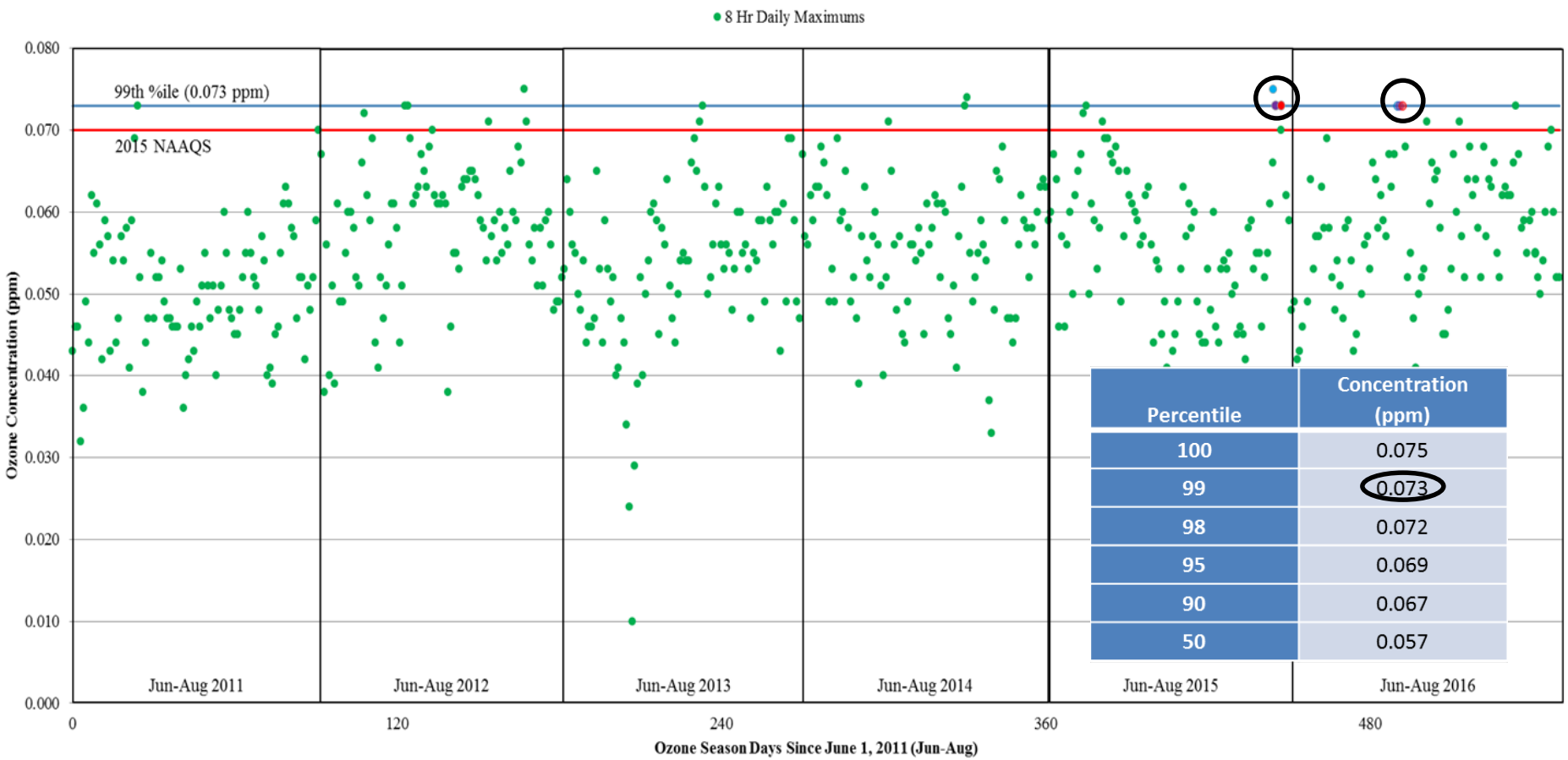


Date	Distance (km)	Acres	Emissions (tons)	Q/D (tpd/km)	Multi-day Q/D (tpd/km)
June 28, 2016	105	350	106	1.00	1.00
June 29, 2016	105	914	276	2.63	3.63
June 30, 2016	105	887	268	2.55	6.18
July 1, 2016	105	1,067	322	3.07	9.25
July 2, 2016	105	718	217	2.06	11.31
July 3, 2016	105	1,508	455	4.34	15.65
July 4, 2016	105	121	37	<1	16.00

- Emissions/Distance
  - NOx + VOC (tons/day)
  - Distance to Monitor (km)
- Q/D > 100 (tpd/km)
- BlueSky Playground
  - Lat/Long – Fire Ignition
  - Emission Type – Wildfire
  - Fuel Moisture – Very Dry
  - FCCS Fuelbed – Default
  - 2015 and 2016 Q/D < 100

Comparison of Event to Historical Concentrations

8-Hour Daily O_3 Maximums June-August, 2011-2016



Percentile	Concentration (ppm)
100	0.075
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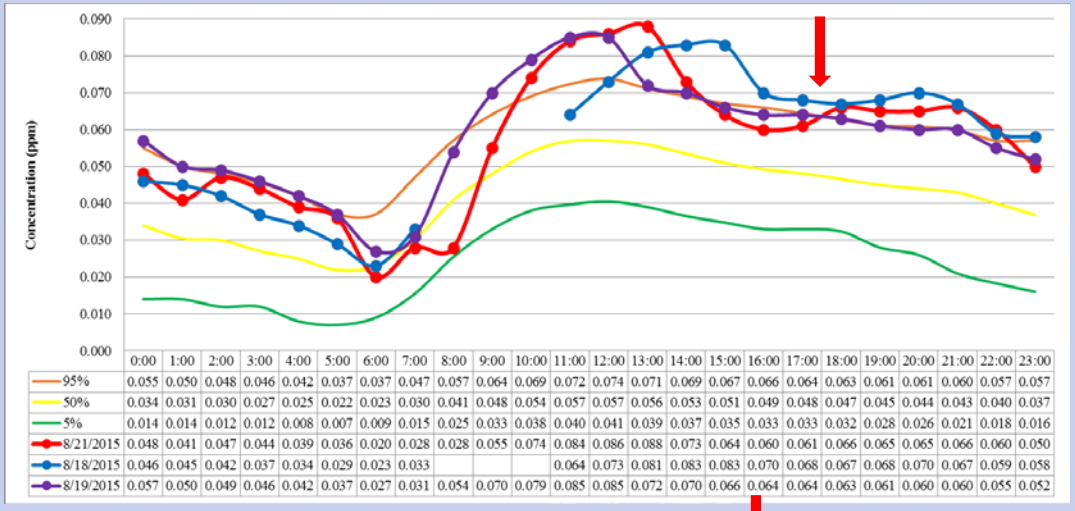
Comparison of Event to Historical Concentrations

Percentiles for Hourly Seasonal Diurnal Ozone (2011-2015) Compared to Exceptional Events



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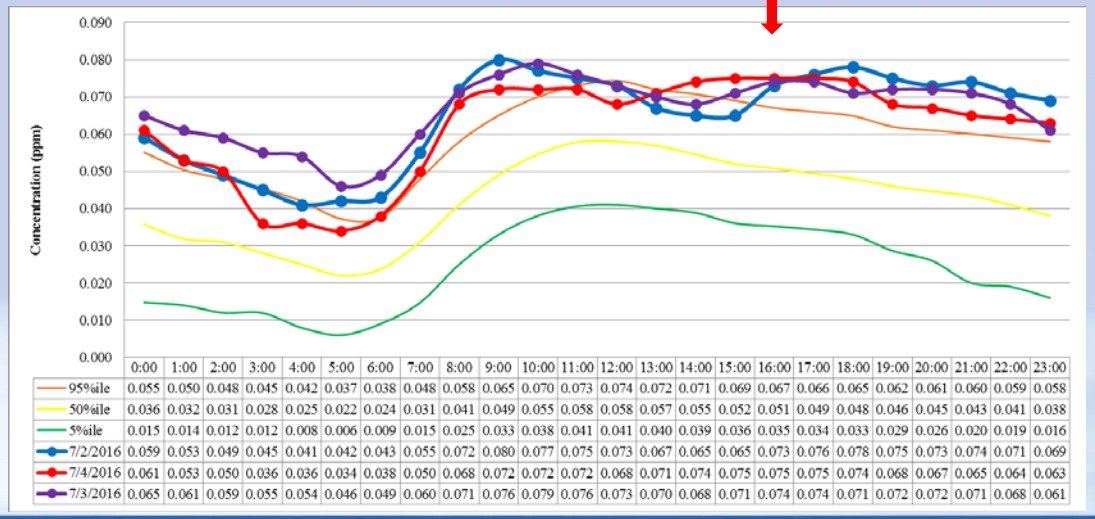
95%	0.055	0.050	0.048	0.046	0.042	0.037	0.037	0.047	0.057	0.064	0.069	0.072	0.074	0.071	0.069	0.067	0.066	0.064	0.063	0.061	0.061	0.060	0.057	0.057
50%	0.034	0.031	0.030	0.027	0.025	0.022	0.023	0.030	0.041	0.048	0.054	0.057	0.057	0.056	0.053	0.051	0.049	0.048	0.047	0.045	0.044	0.043	0.040	0.037
5%	0.014	0.014	0.012	0.012	0.008	0.007	0.009	0.015	0.025	0.033	0.038	0.040	0.041	0.039	0.037	0.035	0.033	0.033	0.032	0.028	0.026	0.021	0.018	0.016
8/21/2015	0.048	0.041	0.047	0.044	0.039	0.036	0.020	0.028	0.028	0.055	0.074	0.084	0.086	0.088	0.073	0.064	0.060	0.061	0.066	0.065	0.065	0.066	0.060	0.050
8/18/2015	0.046	0.045	0.042	0.037	0.034	0.029	0.023	0.033				0.064	0.073	0.081	0.083	0.083	0.070	0.068	0.067	0.068	0.070	0.067	0.059	0.058
8/19/2015	0.057	0.050	0.049	0.046	0.042	0.037	0.027	0.031	0.054	0.070	0.079	0.085	0.085	0.072	0.070	0.066	0.064	0.064	0.063	0.061	0.060	0.060	0.055	0.052



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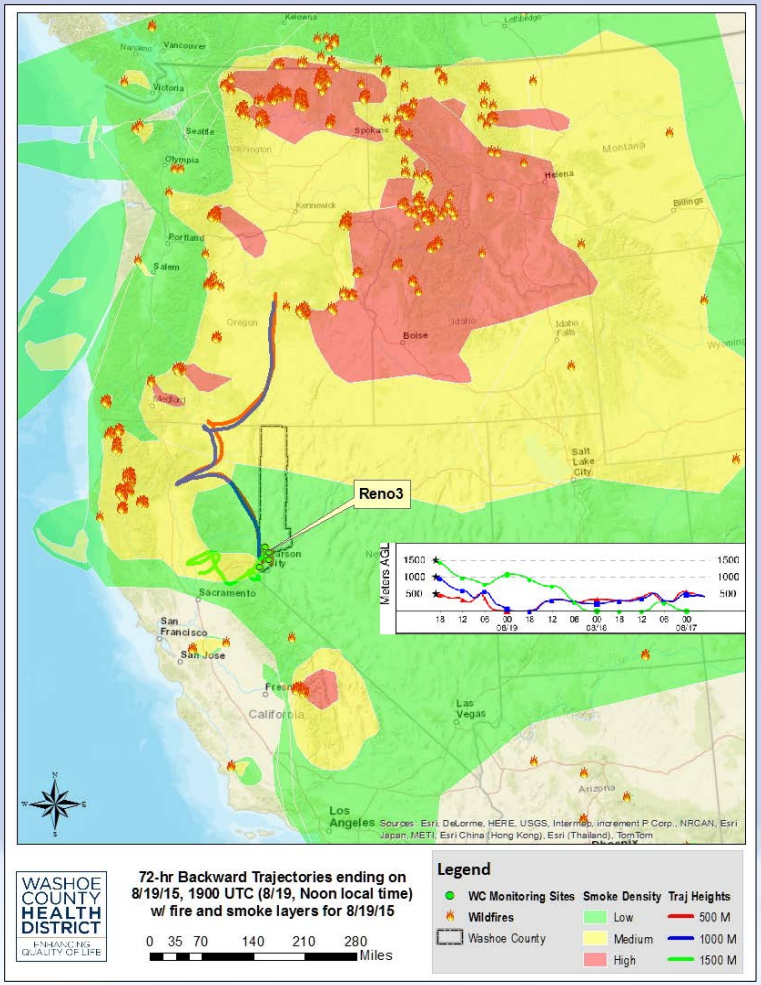
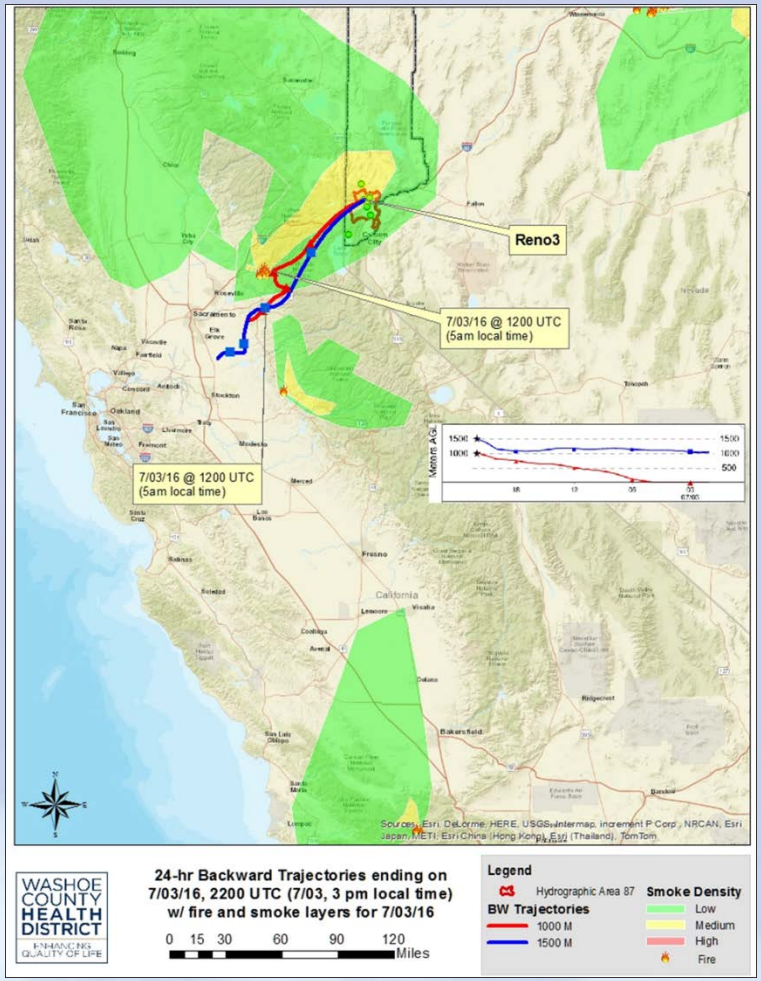
50%ile	0.036	0.032	0.031	0.028	0.025	0.022	0.024	0.031	0.041	0.049	0.055	0.058	0.058	0.057	0.055	0.052	0.051	0.049	0.048	0.046	0.045	0.043	0.041	0.038
5%ile	0.015	0.014	0.012	0.012	0.008	0.006	0.009	0.015	0.025	0.033	0.038	0.041	0.041	0.040	0.039	0.036	0.035	0.034	0.033	0.029	0.026	0.020	0.019	0.016
7/2/2016	0.059	0.053	0.049	0.045	0.041	0.042	0.043	0.055	0.072	0.080	0.077	0.075	0.073	0.067	0.065	0.065	0.073	0.076	0.078	0.075	0.073	0.074	0.071	0.069
7/4/2016	0.061	0.053	0.050	0.036	0.036	0.034	0.038	0.050	0.068	0.072	0.072	0.072	0.068	0.071	0.074	0.075	0.075	0.075	0.074	0.068	0.067	0.065	0.064	0.063
7/3/2016	0.065	0.061	0.059	0.055	0.054	0.046	0.049	0.060	0.071	0.076	0.079	0.076	0.073	0.070	0.068	0.071	0.074	0.074	0.071	0.072	0.072	0.071	0.068	0.061

- Hourly Historical O_3 Compared to Events
- Above the 95th%tile for Several Hours
- O_3 Evening Peaks
- O_3 15-17ppb Higher than Non-Event Days

Trajectory Analysis

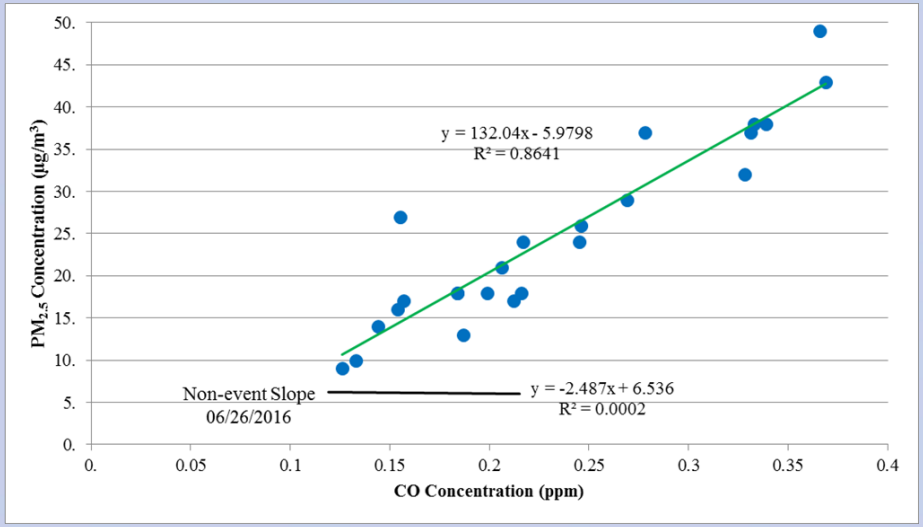
Backward HYSPLIT Trajectories and HMS Detected Smoke Plumes



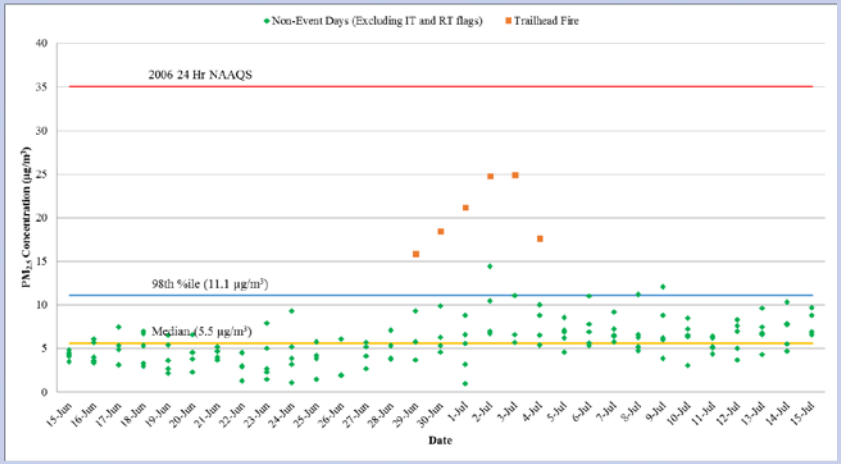


$PM_{2.5}$ Analysis (2016 EE)

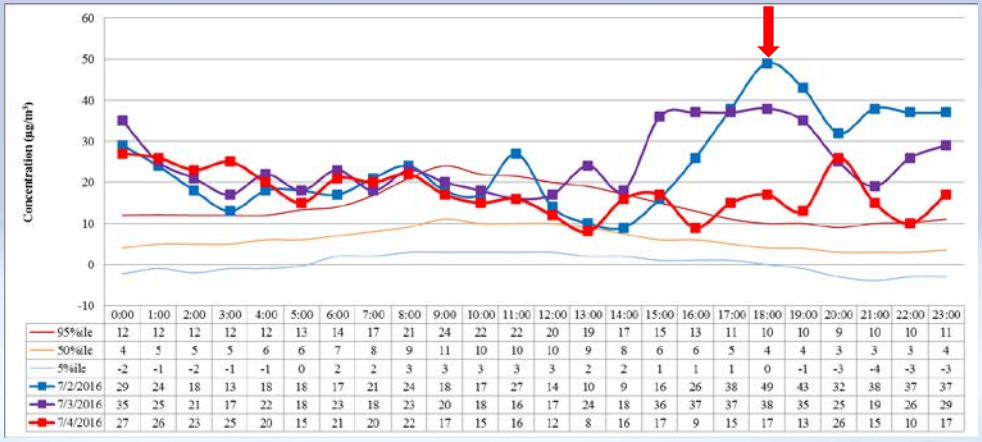
Hourly Reno3 $PM_{2.5}$ and CO for July 2, 2016



24-Hour $PM_{2.5}$ Averages



Percentiles for Hourly Seasonal $PM_{2.5}$ Compared to 2016 Events



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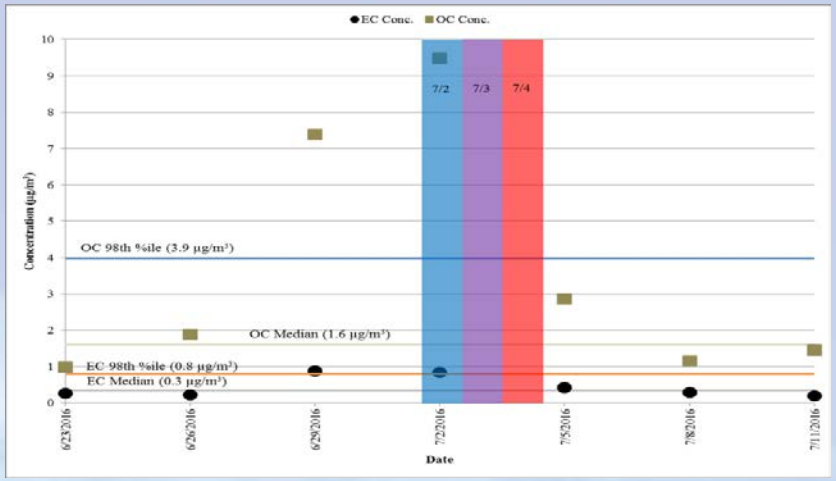
95%ile	12	12	12	12	12	13	14	17	21	24	22	22	20	19	17	15	13	11	10	10	9	10	10	11
50%ile	4	5	5	5	6	6	7	8	9	11	10	10	10	9	8	6	6	5	4	4	3	3	3	4
5%ile	-2	-1	-2	-1	-1	0	2	2	3	3	3	3	3	2	2	1	1	1	0	-1	-3	-4	-3	-3
7/2/2016	29	24	18	13	18	18	17	21	24	18	17	27	14	10	9	16	26	38	49	43	32	38	37	37
7/3/2016	35	25	21	17	22	18	23	18	23	20	18	16	17	24	18	36	37	37	38	35	25	19	26	29
7/4/2016	27	26	23	25	20	15	21	20	22	17	15	16	12	8	16	17	9	15	17	13	26	15	10	17

Elemental & Organic Carbon Concentrations



Additional Evidence
NWS and Smoke Text Products

Area Forecast Discussion
National Weather Service Reno NV
135 PM PDT MON JUL 4 2016

.SYNOPSIS...

Dry and breezy conditions will prevail for the upcoming week. Smoke and haze from the Trailhead fire will move across much of the region each afternoon and evening through the week. A slow cooling trend continues with daytime temperatures near average starting Tuesday.

&&

.SHORT TERM...

Evolution of the forecast model guidance has changed very little today and thus the forecast reasoning has changed little with the models in good agreement.

Biggest impact this coming week will be an increase in winds Tuesday before dropping slightly Wednesday and Thursday. This increase in wind speeds is in response to an incoming long wave trough of low pressure pushing across the Pac NW with the far southern extent affecting our area. The gusty winds will prompt the issuance of Lake Wind Advisories for areas north of Highway 50 for Tuesday. Additional Lake Wind Advisories could be needed for Wednesday. The gusty winds will continue to draw smoke and haze from the Trailhead Fire east and northeast into the forecast area. The amount of smoke and the coverage extent will be hard to determine far in advance as it is dependent on how active the fire becomes.

3/21/2017 Smoke Text Product - Satellite Services Division

Sunday, July 3, 2016

DESCRIPTIVE TEXT NARRATIVE FOR SMOKE/DUST OBSERVED IN SATELLITE IMAGERY THROUGH 0100Z July 4, 2016

SMOKE:
Northwestern to South Central Canada/Great Lakes Region:
An extensive area of light density remnant smoke from fires in the Northwest Territories, northern Saskatchewan, northern Alberta, and northern Manitoba extends southeastward from northwest Nunavut to southern Ontario and the northern Great Lakes. Moderately dense to dense smoke is especially prevalent over the Northwest Territories directly north of the bulk of the fire activity. Numerous wildfires were seen in between cloud cover emitting light to heavy density smoke to the north in northern Saskatchewan and southeast of Great Slave Lake in the Northwest Territories. Wildfires in northern Manitoba were producing light to moderate density smoke to the west.

California/Nevada:
Areas of thin to moderately dense remnant smoke were seen over parts of northern and southern California, and Nevada. This smoke is largely from the Trailhead fire in California, the fire named Pine in Ventura County California and the Hot Pot fire in northern Nevada. The Pine fire was fanning light to moderate density to the southwest and northwest while the Trailhead fire in the Sierra foothills continues to emit a light to moderate density smoke plume to the northeast into western Nevada. The Hot Pot brush fire in west-central Elko county Nevada was seen spreading quickly to the east-northeast in shortwave IR imagery. A light to heavy density smoke plume was emanating to the east-northeast from this brush fire although clouds obscured the full extent of this smoke to the east.

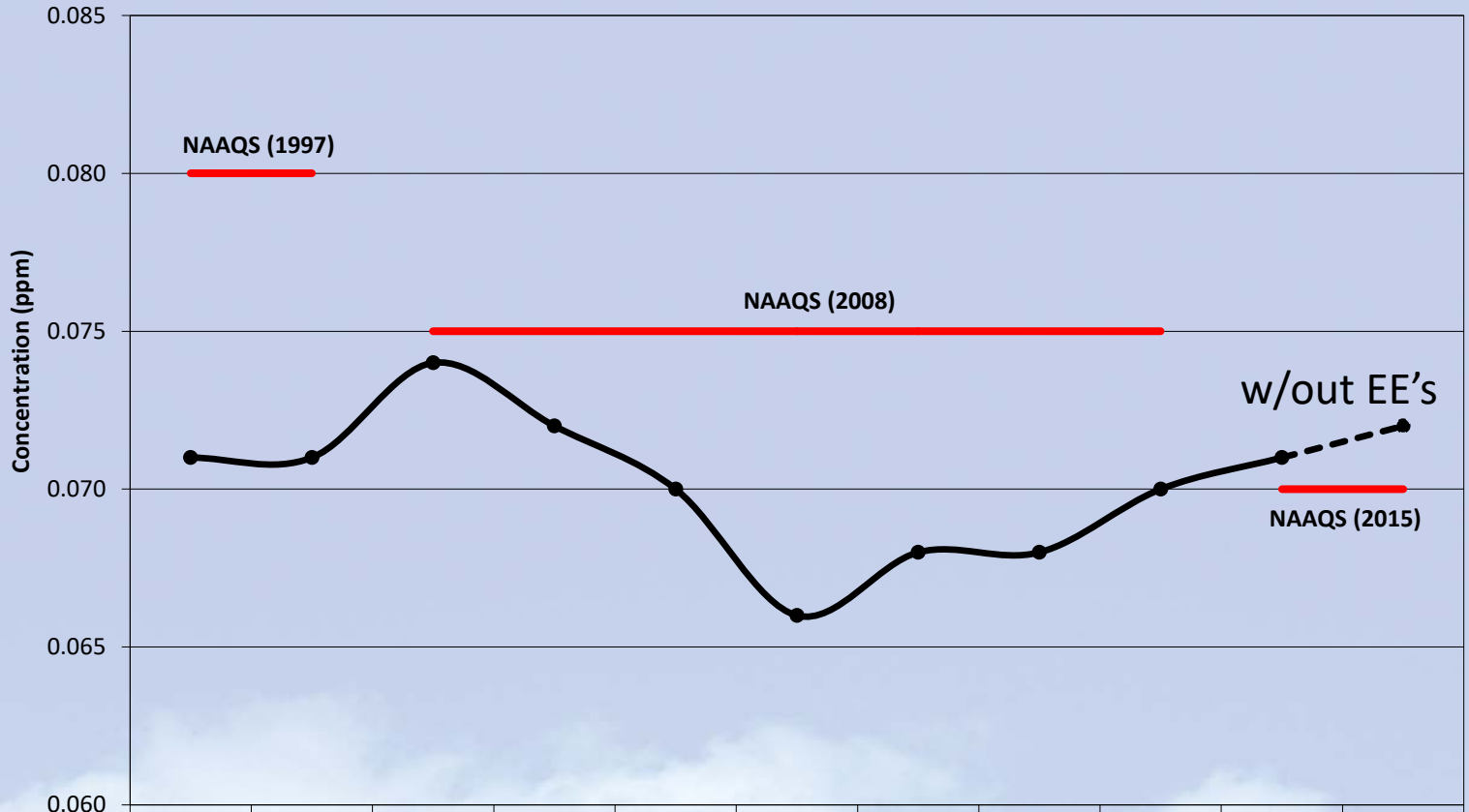
Exceptional Events Demonstrations Conclusions and Recommendations

- Justify as an EE under 40 CFR 50.14
  - Wildfire Emissions Caused O_3 Exceedances at Reno3
  - A Clear Causal Relationship Exists
  - Event Concentrations Above Historical
  - Event was a Natural Event
  - Was not Reasonably Controllable or Preventable

Requesting Exclusion of Data from 2015 and 2016 Events

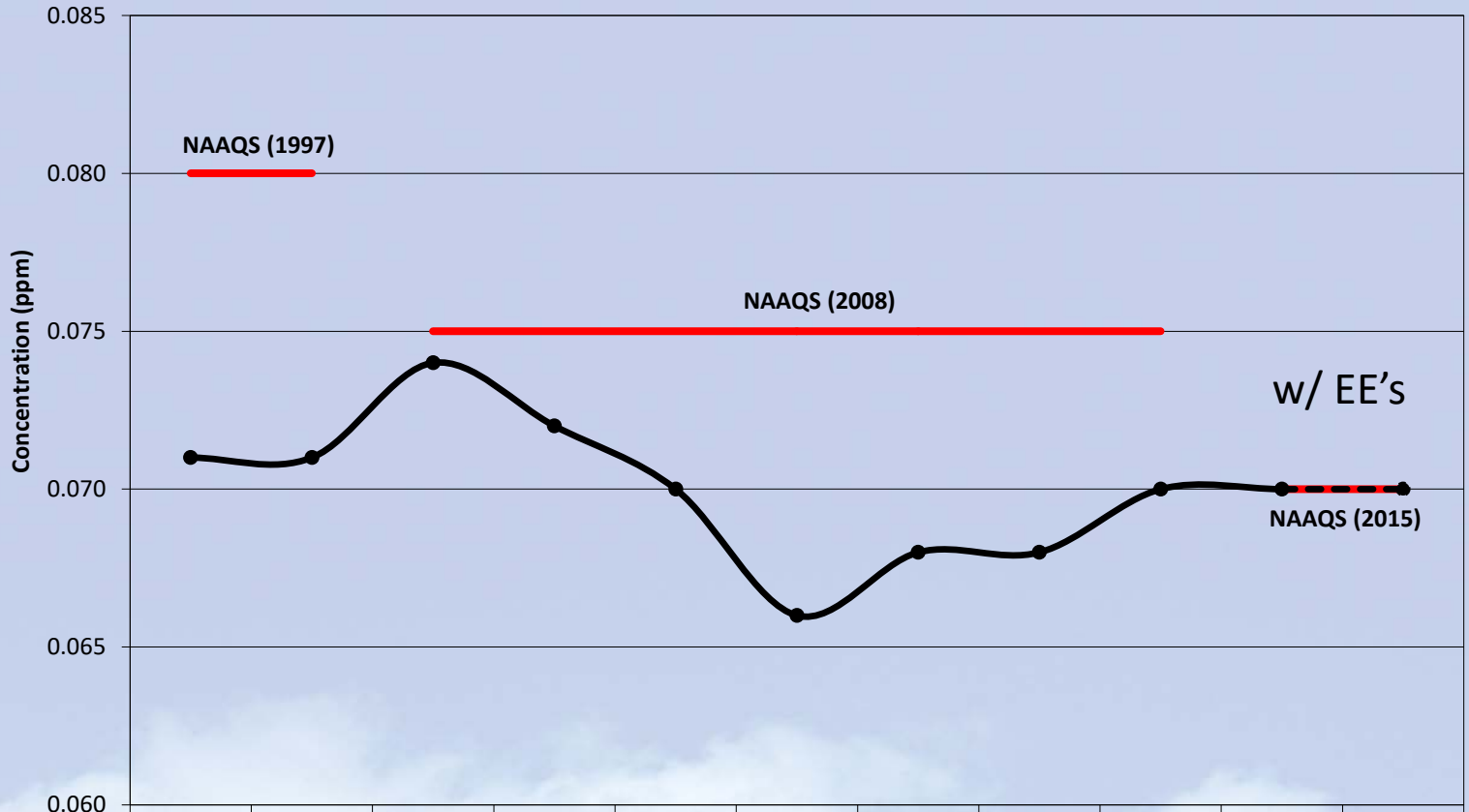
Date of Event	Type of Event	NAAQS Standard	Site Name	Monitor Concentration
8/18/2015	Wildfires	8- Hour Ozone	Reno3	0.075ppm
8/19/2015	Wildfires	8- Hour Ozone	Reno3	0.073ppm
8/21/2015	Wildfires	8- Hour Ozone	Reno3	0.073ppm
7/2/2016	Wildfires	8- Hour Ozone	Reno3	0.073ppm
7/3/2016	Wildfires	8- Hour Ozone	Reno3	0.073ppm
7/4/2016	Wildfires	8- Hour Ozone	Reno3	0.073ppm

8-hr Ozone Trends vs. NAAQS Without EE Concurrence



	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
NAAQS	0.08	0.08	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.070	0.070
Design Value	0.071	0.071	0.074	0.072	0.070	0.066	0.068	0.068	0.070	0.071	0.072

8-hr Ozone Trends vs. NAAQS with EE Concurrence



	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
NAAQS	0.08	0.08	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.070	0.070
Design Value	0.071	0.071	0.074	0.072	0.070	0.066	0.068	0.068	0.070	0.070	0.070

Questions and Comments

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