Exceptional Event Demonstration for High Ozone in Northern California Counties due to Wild Fires

The purpose of this report is to provide documentation regarding the impacts of the catastrophic wildfires that burned throughout northern California in June and July of 2008 on exceedances of the revised federal 8-hour ozone standard. The sites included in this report are all in current or proposed nonattainment areas, and the exclusion of the flagged data would not affect their attainment/nonattainment status. However, the scale and duration of the 2008 fires significantly increased 8-hour ozone concentrations over a broad period of time and therefore adversely impact the design value for these sites. As such, given that the fires were natural events that were clearly not reasonably preventable or controllable, and that a clear causal relationship between the fires and increased ozone concentrations can be demonstrated, we believe that it is inappropriate to use the data specified in this document for calculating design values.

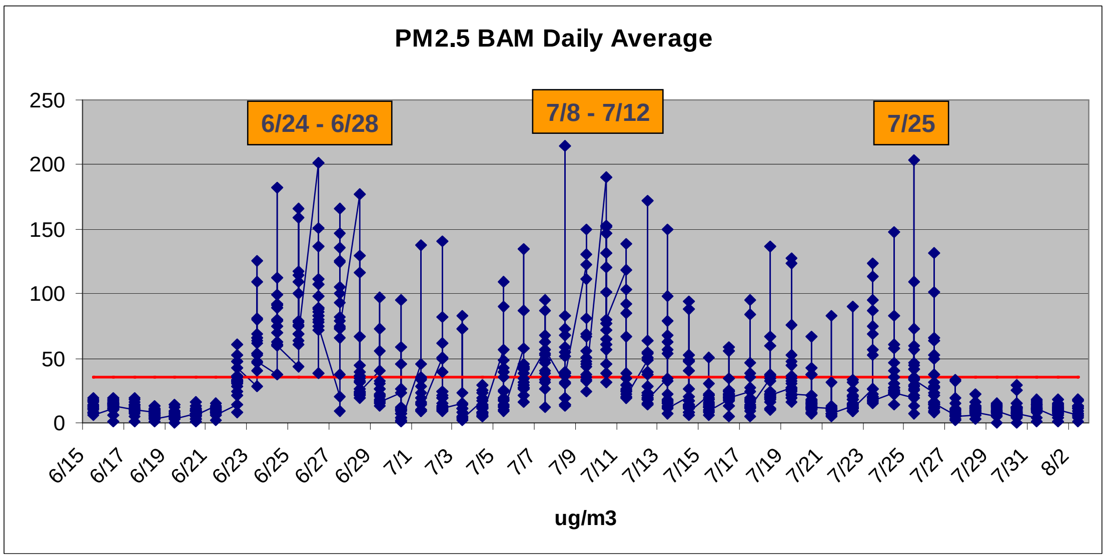
While emissions from the wildfires likely enhanced ozone concentrations throughout June and July, this report focuses on exceedances that occurred during three discrete northern California wildfire episodes – June 23-28, July 7-10, and July 24-26. Table 1 lists the affected counties and dates where air quality was adversely impacted by wildfires emissions during these periods. A more detailed site specific listing is provided in Appendix 1.

Table 1
Northern California Counties Affected by Wildfires

County	Dates Affected by Wildfires
Alameda	July 7, 8, 9
Napa	July 8
Contra Costa	June 24, 27; July 7, 8, 9
Solano	July 7, 8, 9
Yolo	June 24, 27; July 7, 9; July 24, 25
Butte	June 23, 24, 25, 26, 27, 28; July 8, 9; July 24, 25
Sutter	June 23, 24, 25, 26, 27, 28; July 7, 9; July 24, 25
Colusa	June 27
Sacramento	June 23, 24, 25, 26, 27; July 7, 8, 9, 10; July 24, 25
Placer	June 23, 24, 25, 27, 28; July 7, 8, 9, 10
Tehama	June 23, 24, 25, 26, 27, 28; July 25
Nevada	June 25, 27; July 9, 10; July 25, 26
Mariposa	June 23, 24, 25, 26, 27, 28; July 8, 9, 10; July 25, 26
El Dorado	June 23, 24, 25, 26, 27; July 7, 8, 9, 10; July 25
Tuolumne	June 23, 24, 25, 26, 27, 28; July 7, 8, 9, 10; July 25, 26
Calaveras	June 23, 24, 25, 26, 27, 28; July 10; July 25
Amador	June 23, 25, 26, 27; July 8, 9, 10; July 25
San Benito	June 27; July 8, 9; July 25
Fresno	June 24, 25, 26, 27, 28; July 7, 8, 9, 10; July 25, 26
Kern	June 24, 25, 26, 27, 28; July 8, 9, 10; July 24, 25, 26
Madera	June 23, 24, 25, 26, 27; July 8
Merced	June 23, 24, 25, 26, 27, 28; July 7, 8, 9, 10; July 25
San Joaquin	June 23, 24, 25, 26, 27; July 7, 8, 9, 10; July 25
Stanislaus	June 23, 24, 25, 26, 27, 28; July 7, 8, 9, 10; July 24, 25
Tulare	June 24, 25, 26, 27, 28; July 7, 8, 9, 10; July 24, 26

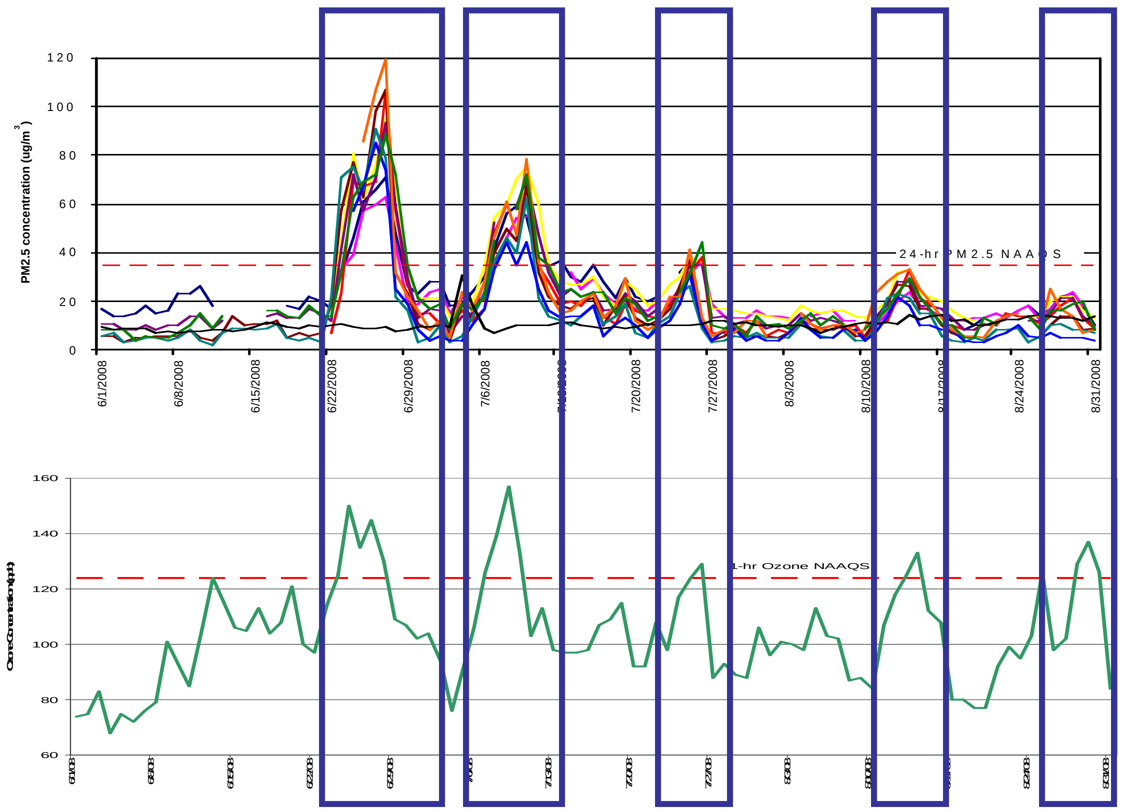
These periods were based on evidence drawn from analysis of particulate concentrations, satellite photos of smoke impacts, meteorological conditions, and comparisons of ozone data to historical norms. Graph 1 illustrates the average daily PM2.5 data from June 15 to August 2 at all northern California monitoring sites. Elevated levels of PM2.5 are evident during the periods of June 24-28, July 8-12, and July 25. Typically, average PM2.5 levels in northern California range from 5 to 17 ug/m3 during June and July. During the wildfire episodes, PM2.5 reached as high as 200 ug/m3. Together, the exceptionally high PM2.5 and ozone levels clearly indicate the influence of wildfires on the adverse air quality in the region.

Graph 1



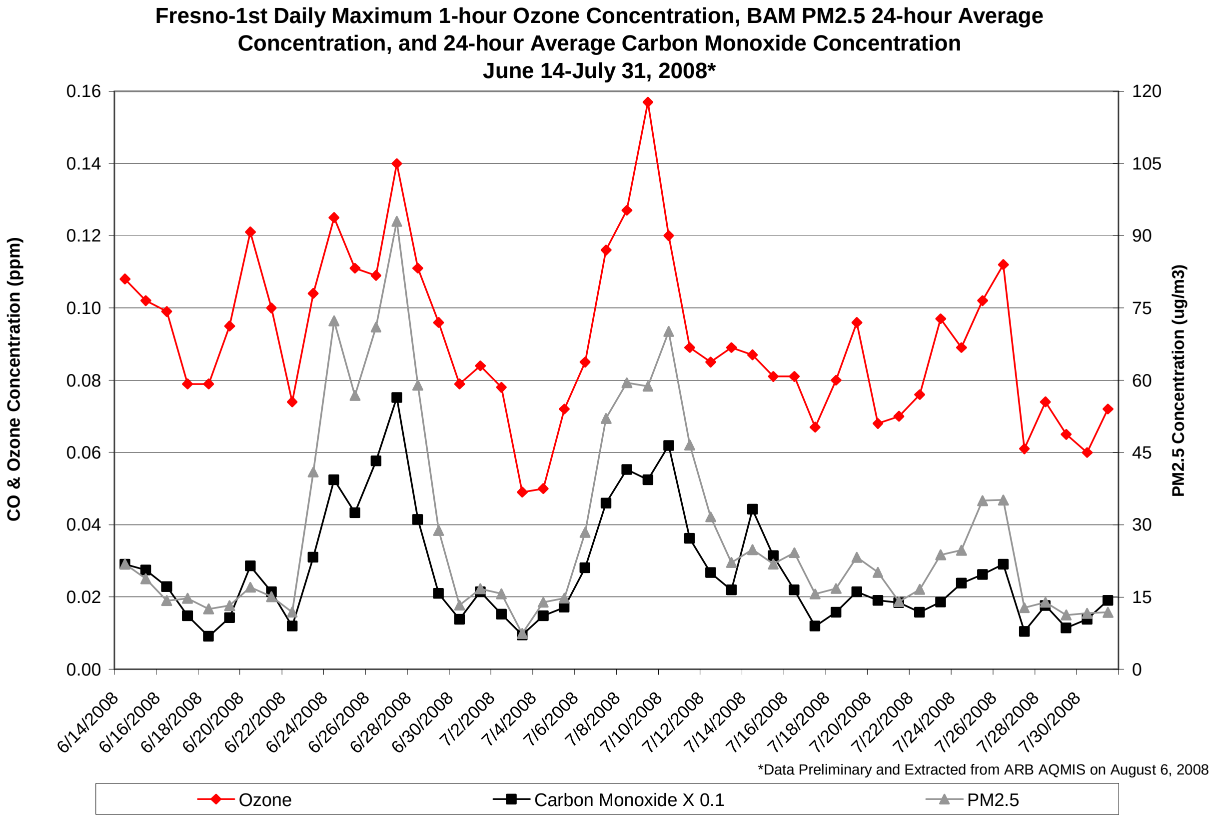
Graph 2 provides a similar analysis for sites in the San Joaquin Valley. The correlation between periods of high PM2.5 with peak ozone concentrations can be clearly seen. The thin black line on the PM2.5 portion of the graph represents typical PM2.5 concentrations for that time of year at Valley sites. Similar to Northern California as a whole, concentrations in the San Joaquin Valley would typically be approximately 10 ug/m3.

Graph 2



Graph 3 provides a clear illustration of the elevated pollutants during the three wildfire episodes for the Fresno monitoring site. This graph shows elevated levels of ozone, carbon monoxide and PM2.5 occurred during each of the three episodes.

Graph 3



The remainder of this report provides information on each of the three discrete periods. Graphs and tables are presented in each episode for example sites to illustrate the types of evidence that demonstrate the impacts of the fires on measured ozone concentrations and demonstrate the clear causal effects of the wildfires on ozone concentrations throughout Northern California.

This report covers sites in northern California with the exception of Shasta, San Luis Obispo, and selected sites in Tehama counties. Documentation for these three areas is being prepared by the respective local air pollution control districts and is being submitted separately to the U.S. Environmental Protection Agency.

California Wildfires

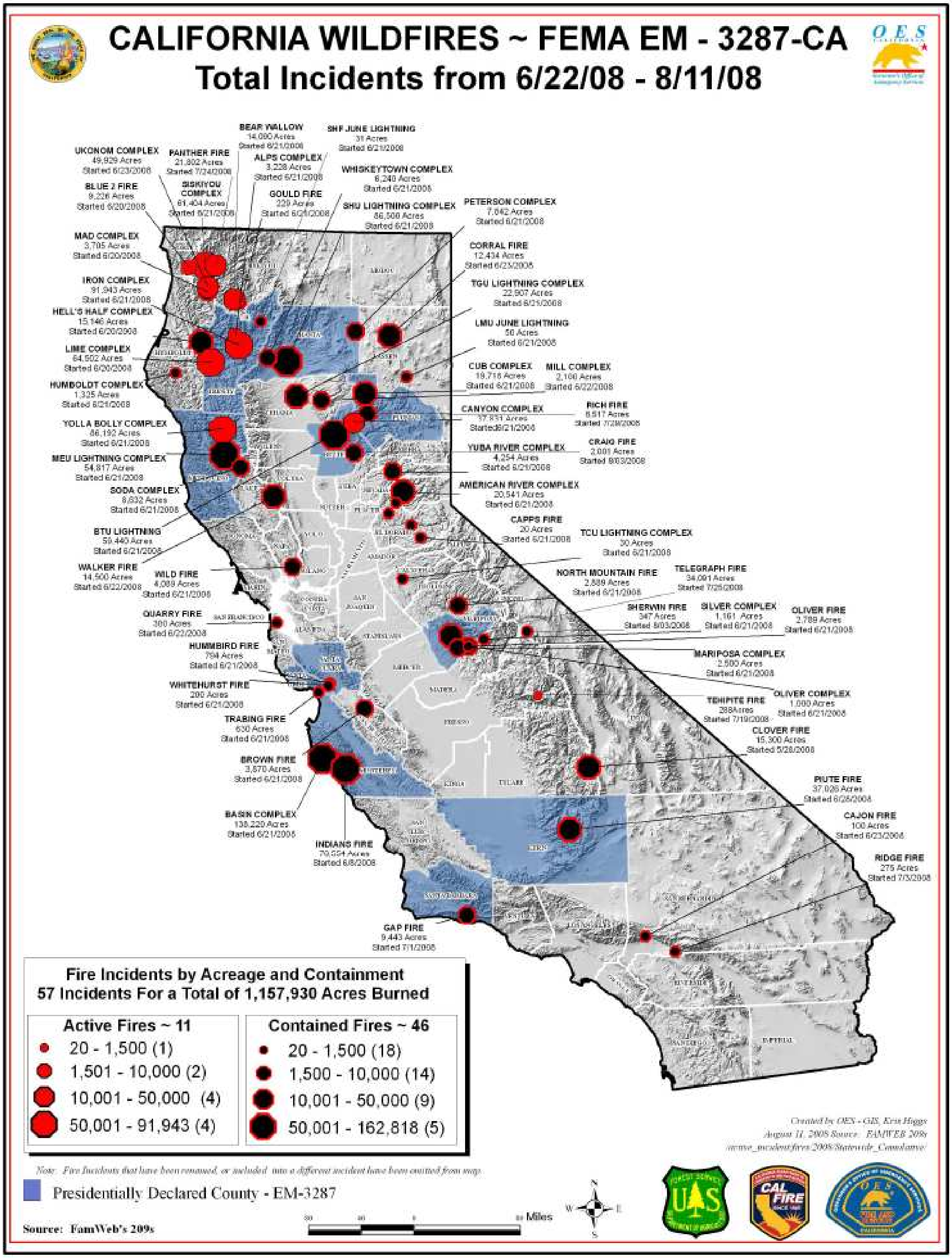
California experienced an unprecedented wildfire season in 2008 fueled by unusually dry landscapes and early season thunderstorms. Statewide rainfall was below normal in 2007 and 2008. Northern California experienced the driest spring on record in 2008 with most communities receiving less than 20 percent of normal rainfall from March to May. The critical dry water conditions prompted Governor Arnold Schwarzenegger to proclaim a statewide drought, the first in over a century.

Under extreme drought conditions, fire was inevitable. The first major fire began on May 22, 2008 in the Santa Cruz Mountains and became known as the Summit Fire. The next major fire to start was the Indians Fire on June 8, 2008 and would be followed by the Basin Complex fire on June 21, 2008. Together, the two fires would burn nearly 215,000 acres in Monterey County. The Humboldt fire in Butte County began on June 11 and was contained by June 21. It was caused by arson and ultimately consumed over 23,000 acres. The BTU Lightning Complex Fire in Butte County began June 21, 2008 and burned over 59,000 acres. During the weekend on June 20-21, a dry low-pressure system crossed through California producing dry lightning and igniting nearly 200 fires across 17 counties, ultimately burning over 700,000 acres.

Three major fires in Humboldt County began on June 20 – the SRF Lightning Complex, the Mad Complex, and Hells Half Complex. These fires burned a combined total of approximately 49,000 acres. Seven lightning strike fires were ignited in Mendocino County between June 20-22 and 11 more fires began between July 4–7. Over 170,000 acres burned in Mendocino County. In Shasta County, the SHU Lightning Complex fire grew increasingly over time to eventually burn over 75,000 acres.

Due to the wildfires, Governor Schwarzenegger issued States of Emergency in several California counties including Santa Cruz, Santa Clara, Placer, El Dorado, Butte, Monterey, Trinity, Mendocino, and Shasta. In addition, the US Federal Emergency Management Agency (FEMA) declared emergencies in Santa Cruz, Santa Clara, Monterey, Santa Barbara, Kern, Mariposa, Mendocino, Butte, Plumas, Trinity and Shasta counties. By the end of summer, over 1.2 million acres burned statewide. Figure 1 shows the locations of the fires that occurred between June 22 and August 11, 2008.

Figure 1


CALIFORNIA WILDFIRES ~ FEMA EM - 3287-CA
Total Incidents from 6/22/08 - 8/11/08
BEAR WALLOW 14,090 Acres Started 6/21/2008
SHF JUNE LIGHTNING 31 Acres Started 6/21/2008
UKONOM COMPLEX 49,929 Acres Started 6/23/2008
PANTHER FIRE 21,802 Acres Started 7/24/2008
ALPS COMPLEX 3,228 Acres Started 6/21/2008
WHISKEYTOWN COMPLEX 6,240 Acres Started 6/21/2008
BLUE 2 FIRE 9,226 Acres Started 6/20/2008
SISKIYOU COMPLEX 61,404 Acres Started 6/21/2008
GOULD FIRE 229 Acres Started 6/21/2008
SHU LIGHTNING COMPLEX 86,500 Acres Started 6/21/2008
PETERSON COMPLEX 7,642 Acres Started 6/21/2008
MAD COMPLEX 3,705 Acres Started 6/20/2008
CORRAL FIRE 12,434 Acres Started 6/23/2008
IRON COMPLEX 91,943 Acres Started 6/21/2008
TGU LIGHTNING COMPLEX 22,907 Acres Started 6/21/2008
HELL'S HALF COMPLEX 15,146 Acres Started 6/20/2008
LMU JUNE LIGHTNING 50 Acres Started 6/21/2008
LIME COMPLEX 64,502 Acres Started 6/20/2008
CUB COMPLEX 19,718 Acres Started 6/21/2008
MILL COMPLEX 2,100 Acres Started 6/22/2008
HUMBOLDT COMPLEX 1,325 Acres Started 6/21/2008
CANYON COMPLEX Started6/21/2008
RICH FIRE 6,517 Acres Started 7/28/2008
YOLLA BOLLY COMPLEX 86,192 Acres Started 6/21/2008
CRAIG FIRE 2,001 Acres Started 8/03/2008
YUBA RIVER COMPLEX 4,254 Acres Started 6/21/2008
MEU LIGHTNING COMPLEX 54,817 Acres Started 6/21/2008
AMERICAN RIVER COMPLEX 20,541 Acres Started 6/21/2008
SODA COMPLEX 8,632 Acres Started 6/21/2008
CAPPS FIRE 20 Acres Started 6/21/2008
BTU LIGHTNING 59,440 Acres Started 6/21/2008
TCU LIGHTNING COMPLEX 30 Acres Started 6/21/2008
WALKER FIRE 14,500 Acres Started 6/22/2008
WILD FIRE 4,089 Acres Started 6/21/2008
NORTH MOUNTAIN FIRE 2,889 Acres Started 6/21/2008
TELEGRAPH FIRE 34,091 Acres Started 7/25/2008
SHERWIN FIRE 347 Acres Started 8/03/2008
SILVER COMPLEX 1,161 Acres Started 6/21/2008
OLIVER FIRE 2,789 Acres Started 6/21/2008
QUARRY FIRE 300 Acres Started 6/22/2008
HUMMBIRD FIRE 794 Acres Started 6/21/2008
MARIPOSA COMPLEX 2,500 Acres Started 6/21/2008
WHITEHURST FIRE 200 Acres Started 6/21/2008
TEHIPITE FIRE 288Acres Started 7/19/2008
OLIVER COMPLEX 1,000 Acres Started 6/21/2008
TRABING FIRE 630 Acres Started 6/21/2008
CLOVER FIRE 15,300 Acres Started 5/28/2008
BROWN FIRE 3,870 Acres Started 6/21/2008
PIUTE FIRE 37,026 Acres Started 6/28/2008
CAJON FIRE 100 Acres Started 6/23/2008
BASIN COMPLEX 138,220 Acres Started 6/21/2008
INDIANS FIRE 79,554 Acres Started 6/8/2008
RIDGE FIRE 275 Acres Started 7/3/2008
GAP FIRE 9,443 Acres Started 7/1/2008
Fire Incidents by Acreage and Containment
57 Incidents For a Total of 1,157,930 Acres Burned
Active Fires ~ 11
20 - 1,500 (1)
1,501 - 10,000 (2)
10,001 - 50,000 (4)
50,001 - 91,943 (4)
Contained Fires ~ 46
20 - 1,500 (18)
1,500 - 10,000 (14)
10,001 - 50,000 (9)
50,001 - 162,818 (5)
Note: Fire Incidents that have been renamed, or included into a different incident have been omitted from map.
Presidentially Declared County - EM-3287
Source: FamWeb's 209s
Miles
Created by OES - GIS, Kris Higgs
CAL FIRE

Geographic Extent

The major geographic features of northern California are the Coastal Ranges, Central Valley, the Cascade Range, and the Sierras. The Coastal Ranges are actually a series of mountain ranges that extend 800 miles from the northwest corner of Del Norte County south to the Mexican border. The San Francisco Bay separates the Coastal Ranges into northern and southern ranges. The northern Coastal Ranges run north-south, forming a barrier between the Pacific Ocean and the Central Valley. The Central Valley is a 500 mile long northwest – southeast oriented valley that is composed of the Sacramento Valley and San Joaquin Valley. The valley elevation extends from a few feet above sea level to almost 500 feet. This long valley is surrounded by the Coastal Mountain Ranges on the west, the Cascade Range on the northeast, the Sierras to the east, and the Tehachapi Mountains to the south. These mountain ranges surrounding the Central Valley form a wall except for lower passes and a small gap in the Coastal Ranges east of the San Francisco Bay area. Elevations in the Coastal Ranges are predominantly between 2,000 – 4,000 feet, but can reach above 7,000 feet. The Cascade Range and Sierras in northern California are typically above 5,000 feet and can exceed 10,000 feet.

Previous Research

The impact of wildfires on ozone concentrations at both the local and regional level has been extensively evaluated in recent years. Nikolov (2008) provide an excellent summary of a number of past studies, as well as a conceptual discussion of the physical and chemical mechanisms contributing to the observed impacts. Nicolov concludes that on a regional scale, biomass burning can significantly increase background surface ozone concentrations resulting in exceedances of regulatory standards. Moreover, these impacts can be observed in areas that may be hundreds of miles away from the fire locations.

Individual studies to evaluate the impacts of wildfires on ozone concentrations include both direct observations such as aircraft flights or ozonesondes, as well as photochemical or smoke plume modeling. Aircraft flights through smoke plumes have demonstrated increased ozone concentrations of 15 to 30 ppb in California (Bush 2008), while ozonsonde measurements in Texas found enhanced ozone aloft of 25 to 100 ppb attributable to long-range transport of smoke plumes from Canada and Alaska (Morris 2006).

Air quality modeling has also been used to estimate increased levels of ozone from a number of large fires. McKeen (2002) found that Canadian fires in 1995 enhanced ozone concentrations by 10 to 30 ppb throughout a large region of the central and eastern United States. Lamb (2007) found similar results in simulating the impacts of fires in the Pacific Northwest in 2006, with increases of over 30 ppb. Junquera (2005) further found that within 10 km of a fire, ozone concentrations could be enhanced by up to 60 ppb. Finally, in one of the most recent studies, Pfister (2008) simulated the large fires of 2007 in both Northern and Southern California. The authors found ozone increases of approximately 15 ppb in many locations. The authors concluded that “Our findings demonstrate a clear impact of wildfires on surface ozone nearby and potentially far downwind from the fire location, and show that intense wildfire periods frequently can cause ozone levels to exceed current health standards.”

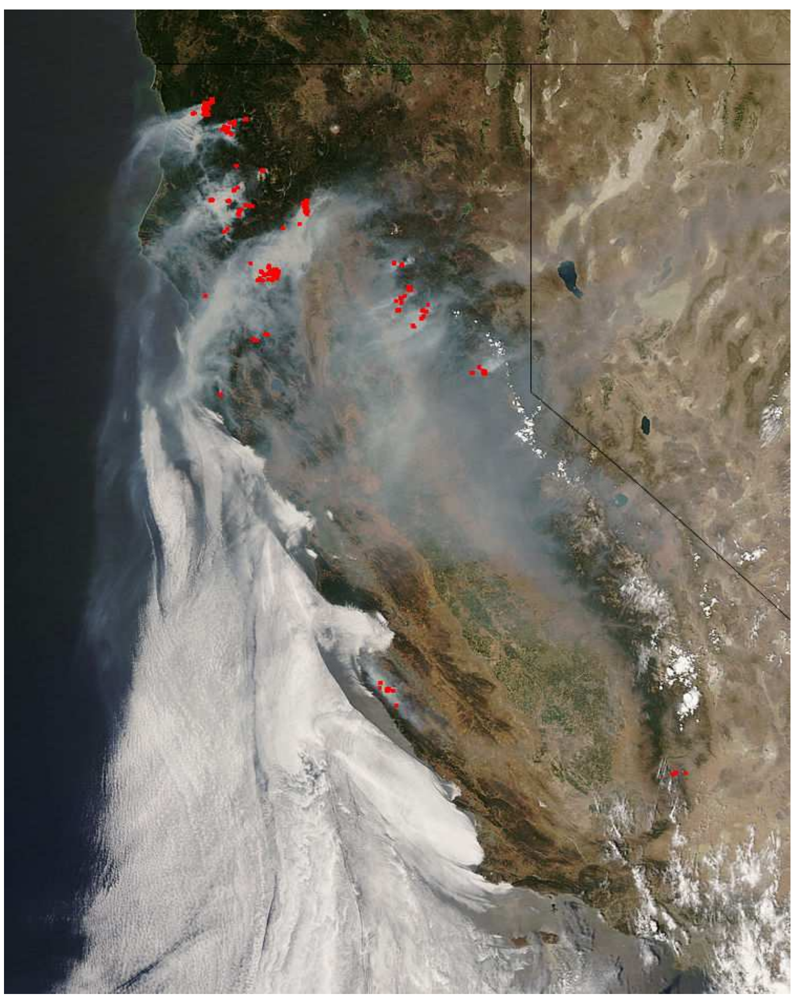
Ozone Episode 1– June 23-28, 2008

Weather Pattern

A storm system moved through Northern and Central California on June 20 and 21, 2008. This storm was associated with a nearly stationary Gulf of Alaska low pressure area. The storm brought thunderstorms, some severe, and cloud to ground lightning. This deluge of lightning strikes – over 6000 in more than 26 counties – along with record dry conditions started over 2000 lightning fires in the California Coastal Ranges and Sierra Nevada Mountains.

Following the storms' passage, air over California stabilized and winds subsided. Over the next several days, smoke began to spread locally in northern California from the many lightning caused wildfires ringing the Sacramento Valley, as seen in NASA satellite images. Two major factors caused smoke to spread over the Sacramento Valley and into the San Joaquin Valley – 1) air movement controlled by localized upslope and down slope winds in the foothills and mountains, and 2) weak winds from the north due to surface high pressure building into the Pacific Northwest. Smoke was reported as far east as Reno, Nevada for several days beginning on June 24. This weather pattern set up the period beginning June 23, of exceedances of the 2008 federal 8-hour ozone standard (0.075 ppm) in northern California. A sample satellite picture from June 25, 2008 shows smoke covering a wide swath of Northern California (Figure 2).

Figure 2



This weather and smoke pattern persisted until June 28 when a weak low pressure area formed off the coast of California and a ridge of high pressure expanded over the Great Basin and into the Pacific Northwest. This new weather pattern resulted in moderate winds from the south. Consistent with this new wind pattern and observed in satellite images, smoke plumes from the wildfires traveled northward into the upper portion of northern California, and as far north as Oregon by June 29. This wind shift brought to a close the first episode of ozone exceedances.

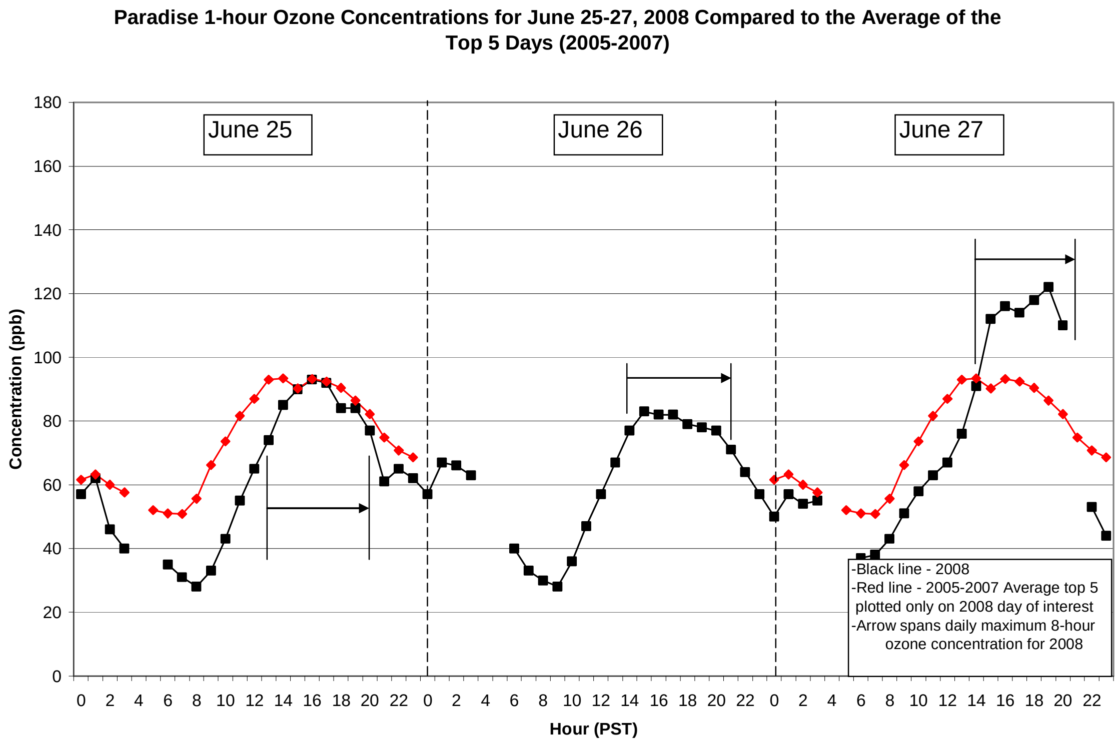
Air Quality Analysis

As a result of the emissions from the wildfires and the meteorological conditions which spread smoke throughout northern California, ozone monitors began recording elevated concentrations on June 23rd. This period of enhanced ozone values extended through June 28th when the smoke began dispersing. The following section provides examples of analyses which demonstrate the impacts of the fires on ozone concentrations.

On June 27, 2008 the Paradise monitor in Butte County reached a peak ozone concentration of 0.122 ppm at 7 pm. The ozone exceedance was a result of south to north ozone progression aloft from the lower Sacramento Valley. Ozone levels were uncharacteristically high in the Sacramento Valley due to the buildup of smoke from the wildfires burning in the Coastal Ranges and throughout the state. At 3 pm on June 27, the Roseville monitor in Placer County measured a 1-hour ozone concentration of 0.122 ppm. Two hours later, the Sutter Buttes monitor in Sutter County measured a 1-hour concentration of 0.122 ppm. Two hours after that, the Paradise peak 1-hour concentration occurred. Finally, at 10 pm the Tuscan Butte monitor in Tehama County recorded a 1-hour ozone value of 0.118 ppm, accompanied by strong winds blowing 20 – 25 mph from the southwest for several hours prior to the peak hour. Winds of this magnitude and duration are sufficient to transport emissions over the 125 mile distance from Sacramento to Tuscan Butte. This data clearly indicates that ozone precursors emitted from the wildfires in the Sacramento Valley lead to ozone formation aloft, and progressed northward causing the violation at Paradise.

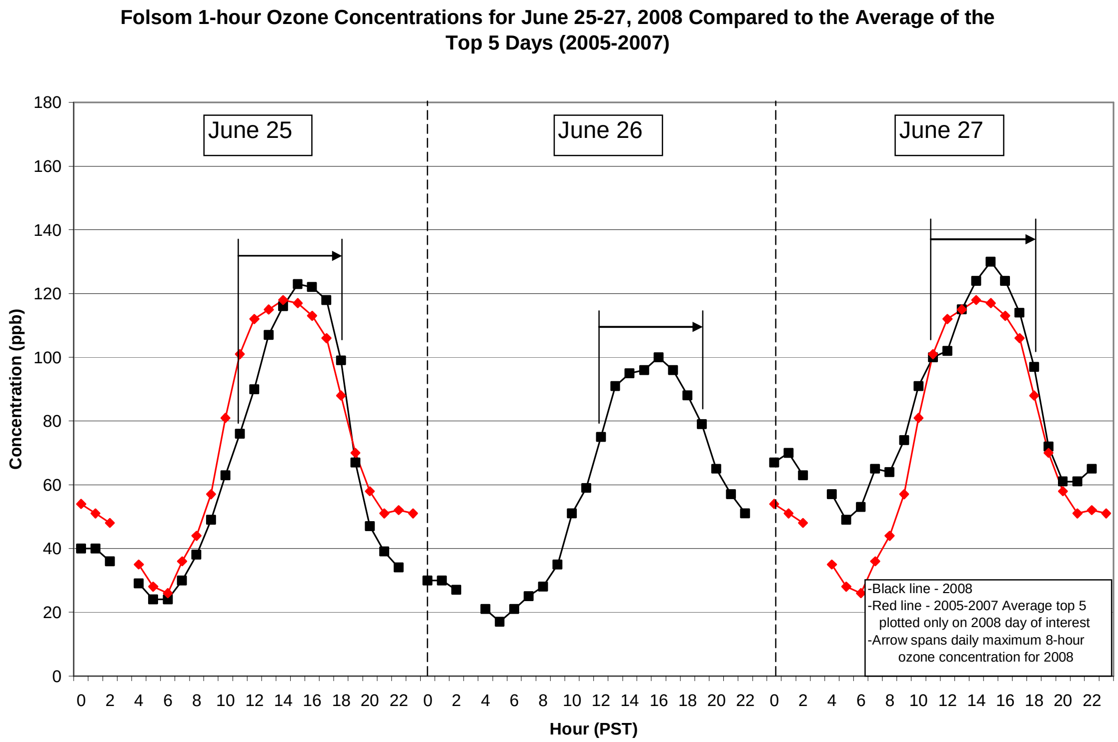
Graph 4 illustrates how the diurnal hourly ozone concentrations at Paradise during the June 27 ozone episode compares to the average of the days with the highest ozone concentrations in 2005-2007. As the graph illustrates, ozone concentrations on June 27 are approximately 20 to 25 ppb higher than the average peak concentrations over the previous three years.

Graph 4



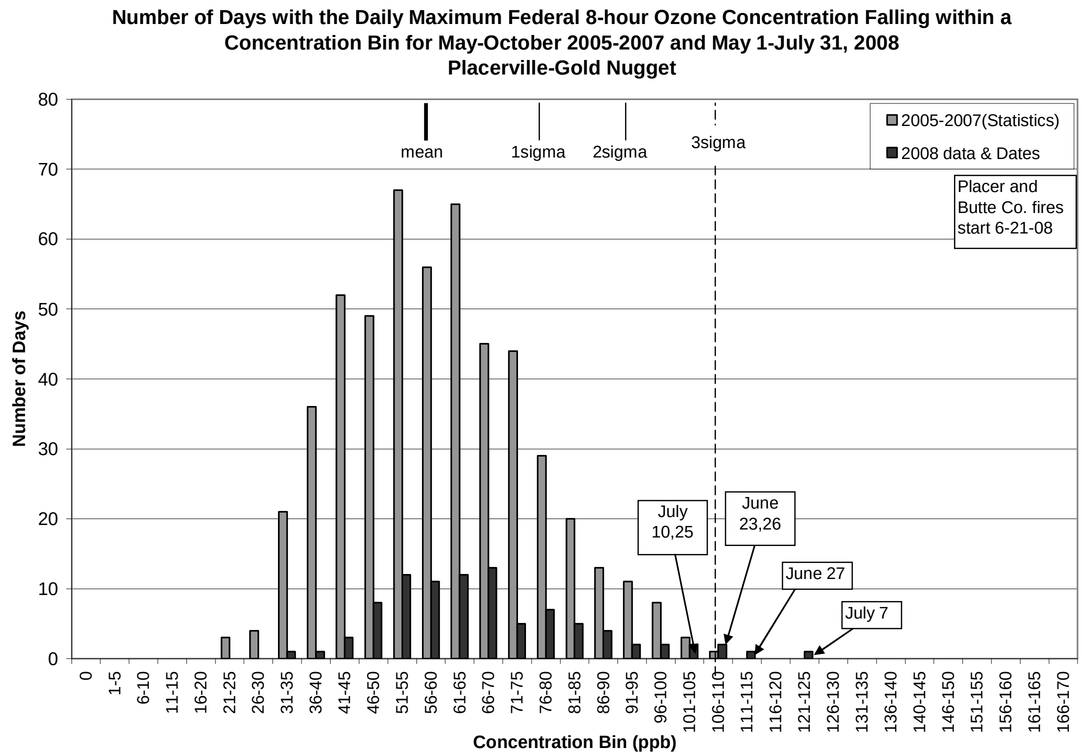
Likewise, Graph 5 illustrate how the diurnal hourly ozone concentrations at the Folsom monitoring site in Sacramento County during smoke impacted days compare to the average of the days with the highest ozone concentrations in 2005-2007. This graph shows that ozone concentrations on smoke impacted days are well above the average of the previous three years.

Graph 5

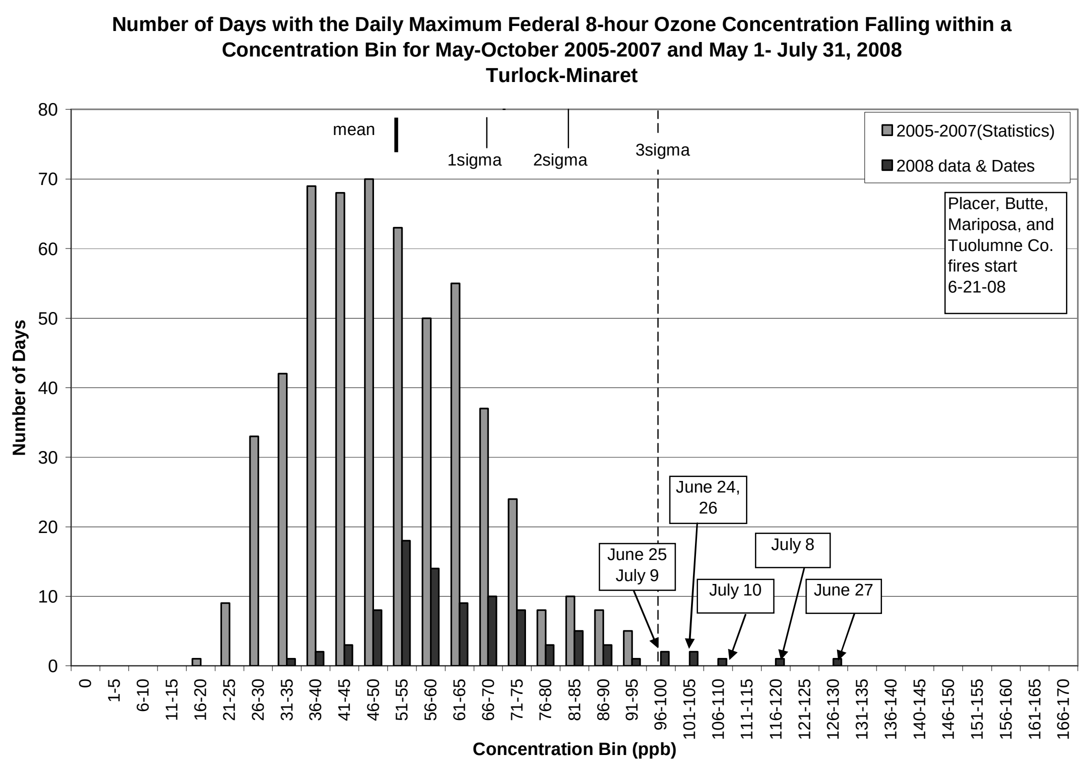


Statistical analysis confirms that ozone concentrations in 2008 were higher than what would be expected based on data over the past three years. Graphs 6-8 show the number of days during the ozone season from 2005 – 2007 that have daily maximum 8-hour ozone concentrations falling within a given range. These graphs represent data from Placerville in El Dorado County, Turlock in Stanislaus County, and Pinnacles National Monument in San Benito County, respectively. This is compared to the number of days in 2008 with ozone concentrations falling within the same concentration ranges. As can be seen from these three graphs, numerous days at each site during the three fire periods are more than three standard deviations above the mean.

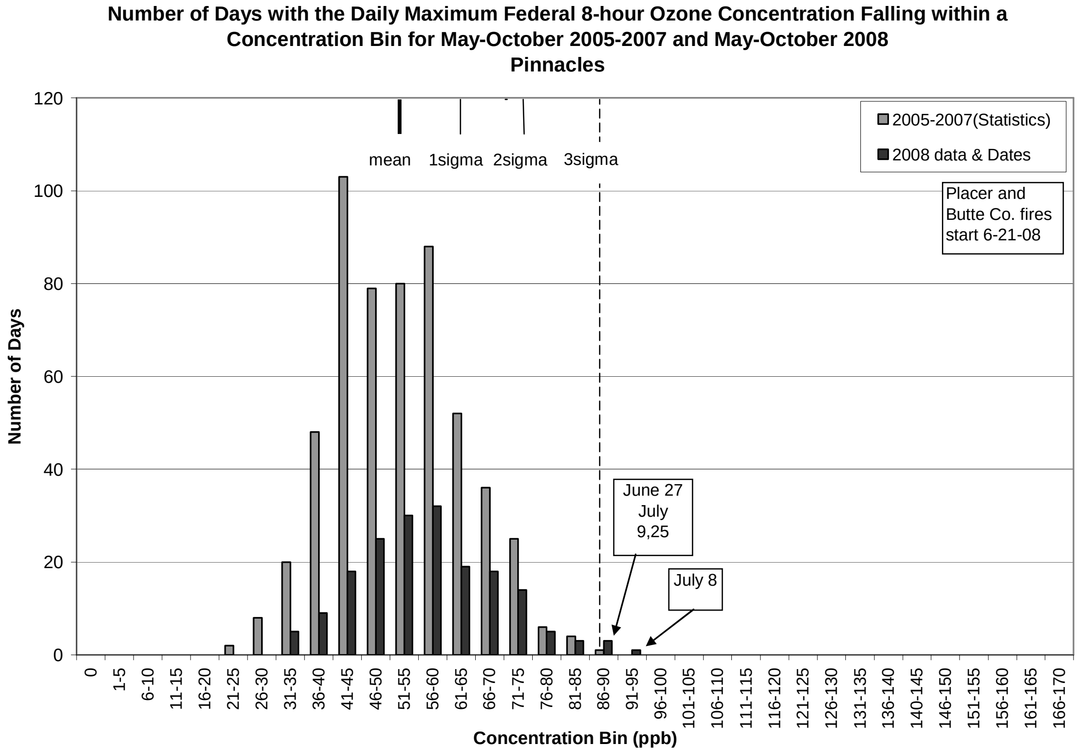
Graph 6



Graph 7

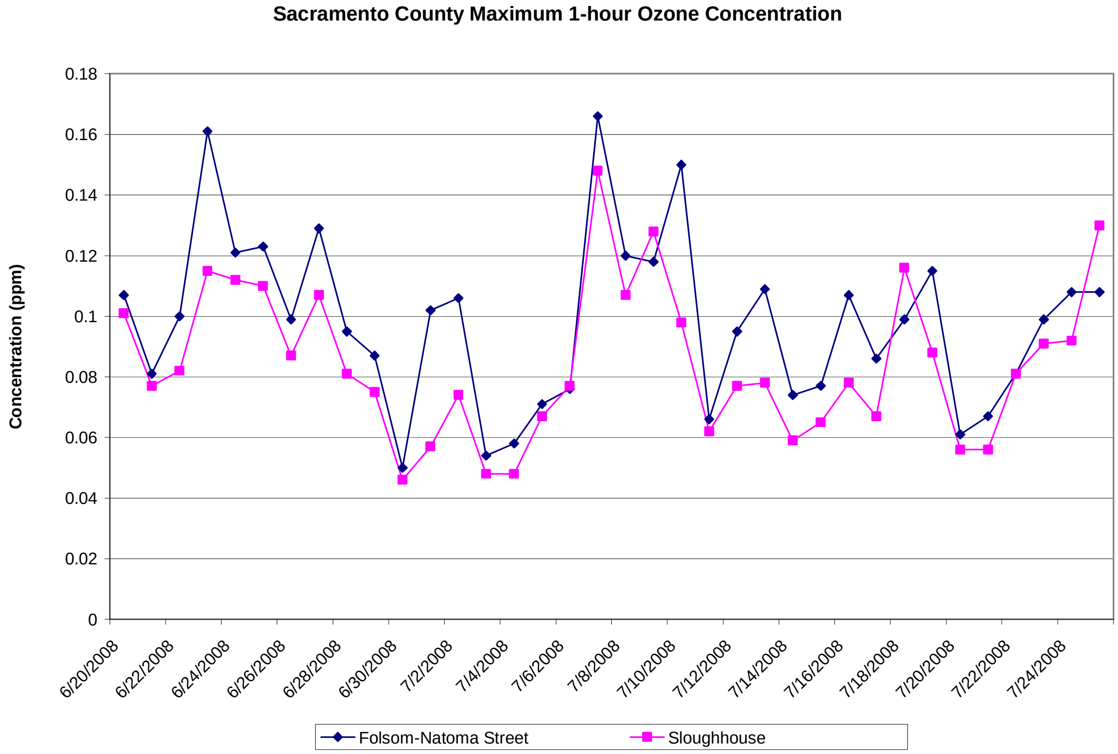


Graph 8



Graph 9 shows the maximum 1-hour ozone concentrations at Folsom and Sloughhouse in Sacramento County from June 20 – July 25, 2008. The pattern of ozone highs and lows are very similar between the two monitoring locations, with Folsom concentrations generally higher than those of Sloughhouse, indicative of a common, regional source such as the wildfires. The graph shows sharp concentration spikes in Folsom on June 23 and June 27, as well as the period of July 7 – 11 in Folsom and Sloughhouse.

Graph 9



The hypothesis that wildfire emissions caused the elevated ozone levels is further supported by the results of an analysis conducted by Sonoma Technology Inc. (STI) under contract with the Sacramento Metropolitan Air Quality Management District. For this analysis, STI used regression equations to estimate the minimum 1-hour ozone contributions due to smoke in Sacramento. The results of this analysis indicate that on June 27 smoke from wildfires contributed 0.054 ppm to the total measured 1-hour concentration of 0.130 ppm at the Folsom monitoring site in Sacramento County. Below, in Table 2, is an example for June 23, 2008 in Sacramento County when the observed hourly maximum ozone concentration was 162.0 ppb.

Table 2
Ozone Contribution from Wildfire Smoke in Sacramento County

Forecast Model	**Predicted Maximum Hourly Ozone (ppb)**	**Bias (ppb)**	**Corrected (ppb)**	**Smoke Contribution: (Observed-Corrected) (ppb)**
0Z Eta	88.8	13.3	73.5	88.5
12Z Eta	89.5	12.7	76.6	85.4
0Z Eta MOS	80.2	8.6	71.6	90.4
12Z Eta MOS	80.7	8.4	72.3	89.7

The estimated peak 1-hour ozone smoke contribution range would be 85.4 ppb to 90.4 ppb for June 23, 2008 in Sacramento County.

Sacramento County's Folsom station observed an ozone concentration of 130 ppb at 1 pm on 6/23/2008. The maximum concentration observed that day at any station in Sacramento County was 162.0 ppb. The estimated minimum smoke contribution, from the example above, is 85.4 ppb. Therefore, the estimated smoke contribution for that day and hour for the Folsom site (based on scaling) is estimated to be 68.5 ppb. The estimated smoke contribution is subtracted from the observed ozone concentration of 130.0 ppb to yield a concentration of 61.5 ppb without smoke impacts. This concentration would represent the estimated observed concentration if the wildfire event did not occur. Therefore, using 1-hour ozone data, but for the fire contribution there would not have been an exceedance at Folsom on June 23, 2008.

Ozone Episode 2– July 7-10, 2008

Weather Pattern

By July 1, an approaching low pressure system out of the Gulf of Alaska began to influence the coastal western states by switching winds from out of the south to out of the southwest. However, high pressure remained over the Great Basin. As winds strengthened out of the southwest by July 3, satellite images show that smoke plumes traveled toward the northeast. This weather pattern kept smoke transported away from the fire areas.

On July 6, the low pressure system from the Gulf of Alaska had passed through the coastal western states, and a high pressure system began building in its place. This surface high pressure brought light offshore winds and stable air to northern California, setting up the next episode of smoky air in northern California. Satellite images for July 6 and 7 show that Coastal Ranges wildfire plumes remained over the fires, while Sierra Nevada fire plumes drifted over into the Sacramento Valley. By July 8, extensive smoke drifted toward the Pacific Ocean from wildfires in the Coastal Ranges. Significant amounts of smoke from the Sierras filled the Sacramento and San Joaquin Valleys as shown in a satellite picture for July 7, 2008 (Figure 3).

By July 9, an upper level high developed over central California, returning northern California to light winds from the southwest. Satellite images show that by this date wildfire plumes had switched from trailing offshore to trailing towards the east, filling Sacramento Valley and northern California with smoke. The wind switch was also evident at Reno, Nevada as visibilities lowered to 3 miles with smoke and haze by July 10.

July 11 brought a more dispersive weather pattern through northern and central California. Satellite images depicted a more dispersed smoke mass over northern California than the previous day. However, higher pressure returned over central California July 12 and July 13. Satellite images show smokier air over northern California for July 12 than the previous day.

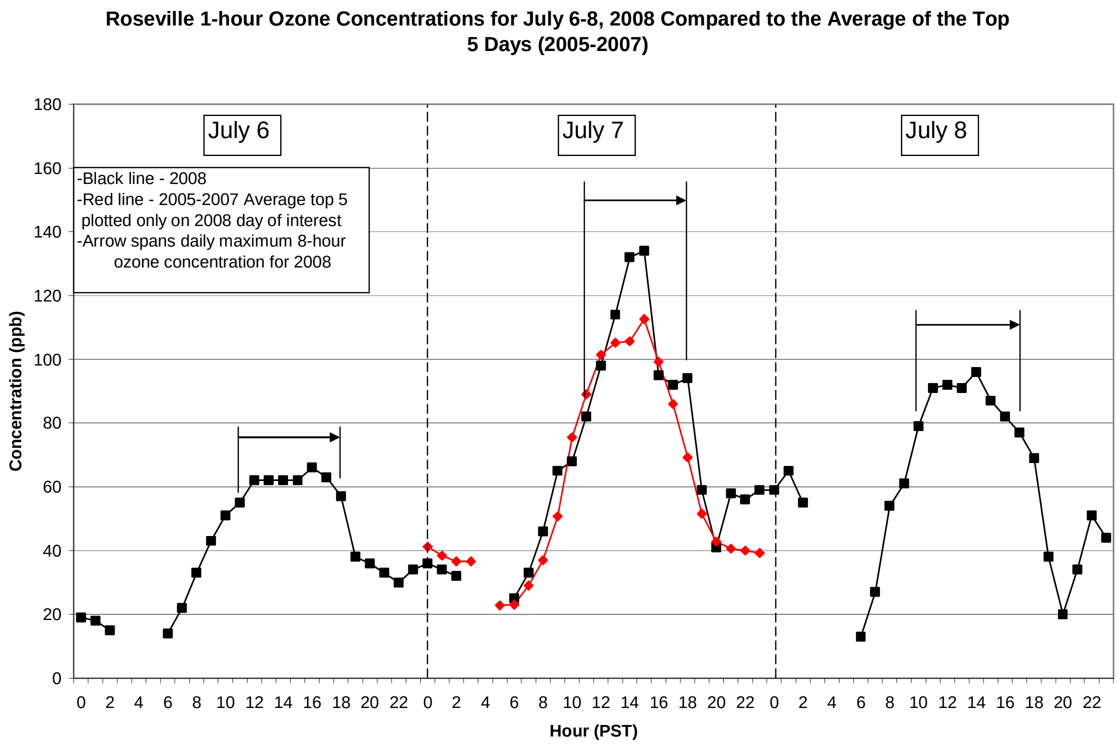
Figure 3

Air Quality Analysis

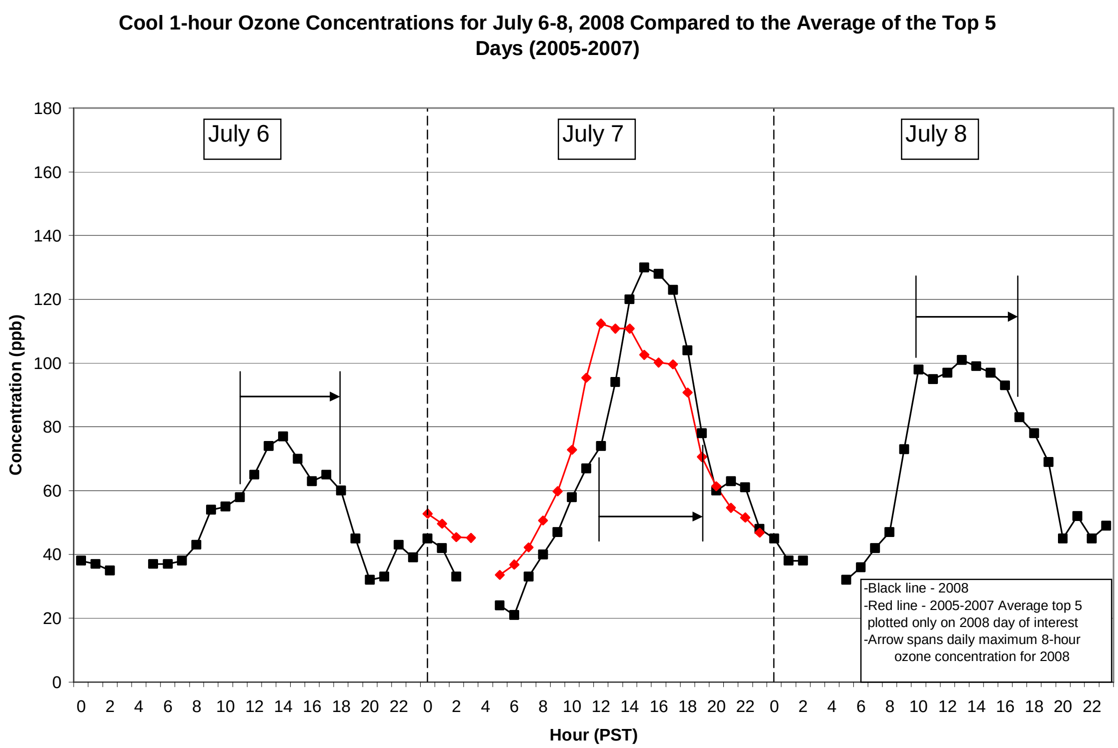
Ozone monitors once again began recording elevated ozone concentrations on July 7 as meteorological conditions shifted to encourage the build up of smoke in northern California. This weather pattern continued until July 11 when smoke began to disperse. The following section provides examples of analyses which demonstrate the impacts of the fires on ozone concentrations during the second ozone episode.

Graphs 10-13 illustrate how the diurnal hourly ozone concentrations at select monitoring sites during the July 6-8 ozone episode compares to the average of the days with the highest ozone concentrations in 2005-2007. As Graph 10 illustrates, ozone concentrations at Roseville on July 7 are approximately 20 ppb higher than the average peak concentrations over the previous three years. Similarly, Graphs 11-13 show that ozone concentrations during the July 6-8 period at Cool, Placerville and Paradise were significantly above the average of the three previous years.

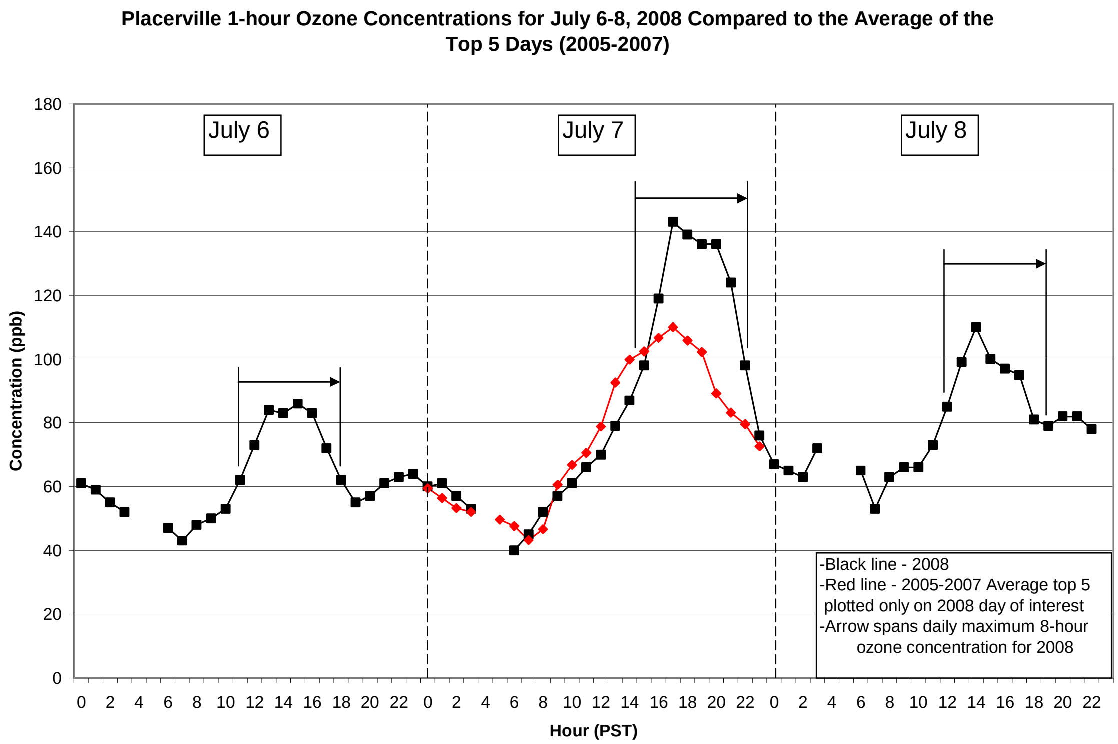
Graph 10



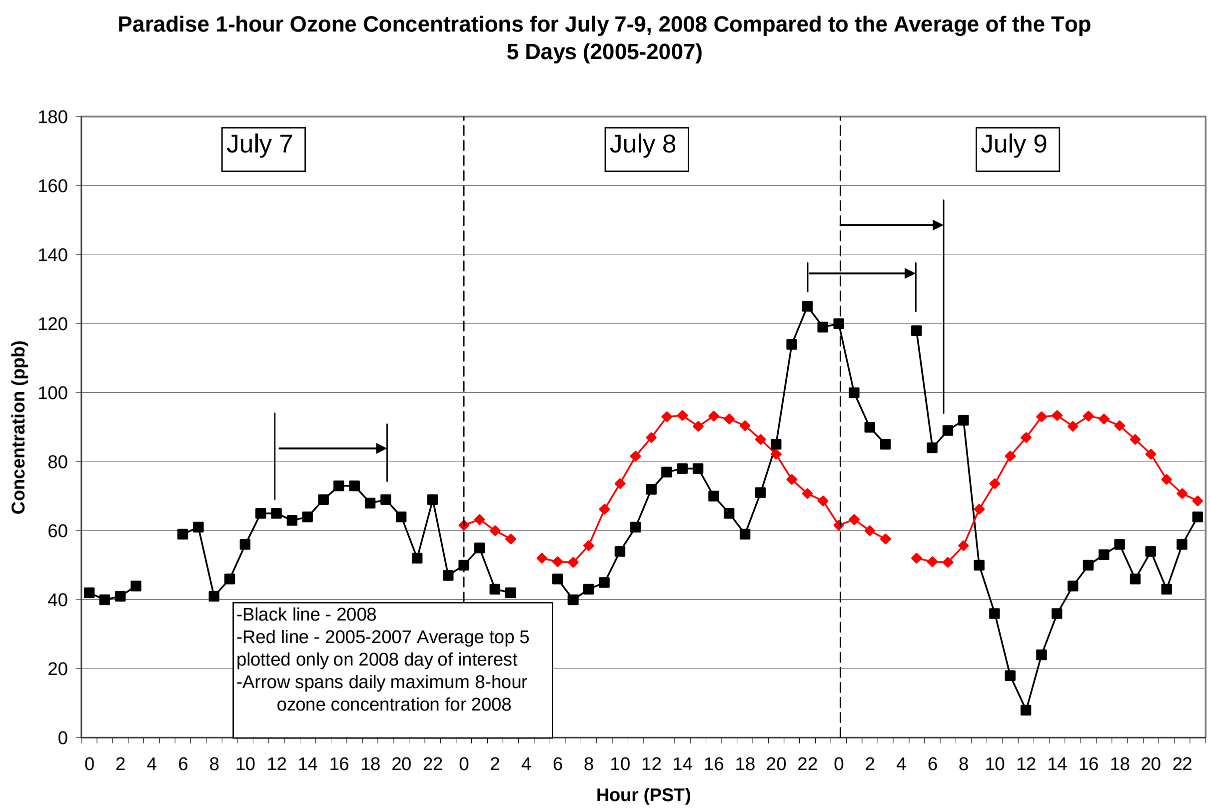
Graph 11



Graph 12

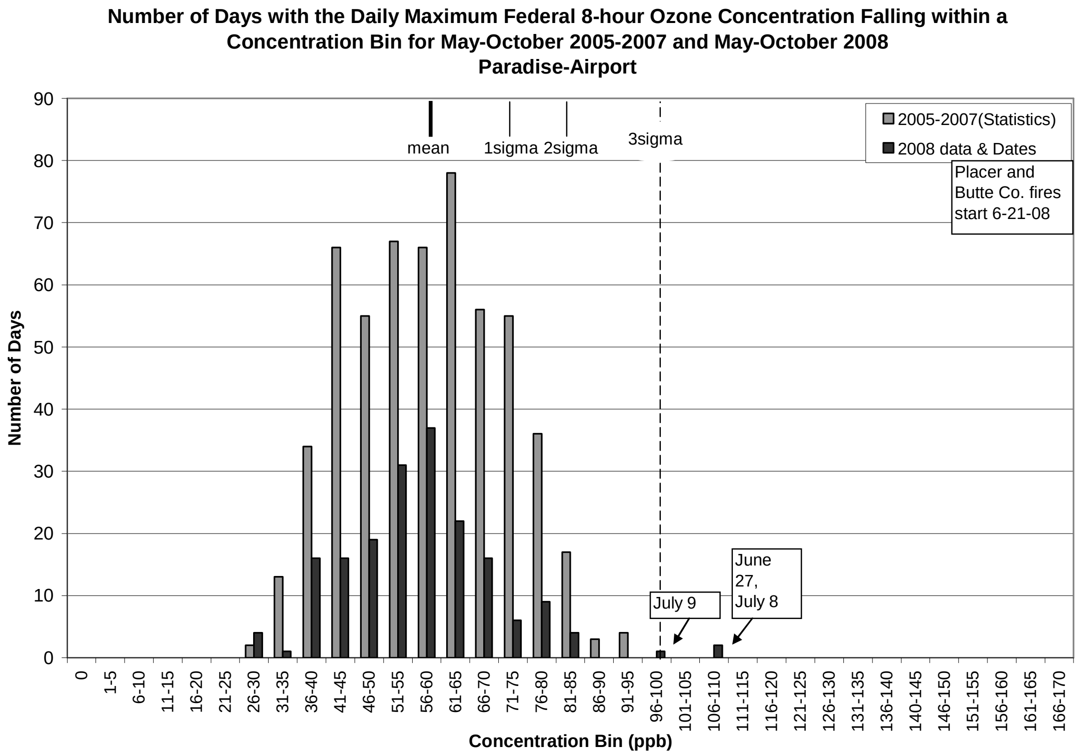


Graph 13



Graph 14 provides a statistical analysis to illustrate that ozone concentrations on June 27, July 8 and July 9 in Paradise were significantly above the average of the past three years.

Graph 14



Ozone Episode 3 – July 24-26, 2008

Weather Pattern

By July 14, the center of a high pressure area over California moved eastward into Nevada, resulting in Coastal Ranges and Sierra wildfire smoke plumes blowing towards the north and northeast. By July 16, the high pressure area expanded to encompass the southern and central US, and brought generally light west winds over the Coastal Ranges and light southwest winds over the Sierra Nevada Mountains. As a result, smoke from the fires in Coastal Ranges blew toward the east to northeast over northern Sacramento Valley and northern California. This smoke pattern persisted into July 19.

A low pressure system developed just off the California coast by July 20, resulting in winds from the south throughout most of central and northern California. The wildfire smoke plumes in the Coastal Ranges responded by blowing northward and away from the Sacramento Valley. This weather and smoke pattern persisted through July 21.

By July 22, a surface high pressure began to build. As a result, winds from the northwest pushed smoke from the Coastal Ranges fires back into the Sacramento Valley, and then curled out toward the ocean covering the Coastal Ranges and the Bay Area with smoke. The low pressure off the California coast had weakened and moved over California, while winds aloft weakened.

The next several days were dominated by a pattern of slowly building high pressure, stable air and continued weak onshore winds over northern and central California. This weather pattern was conducive to the buildup of smoke over the Coastal Ranges and various sections of northern California through July 26.

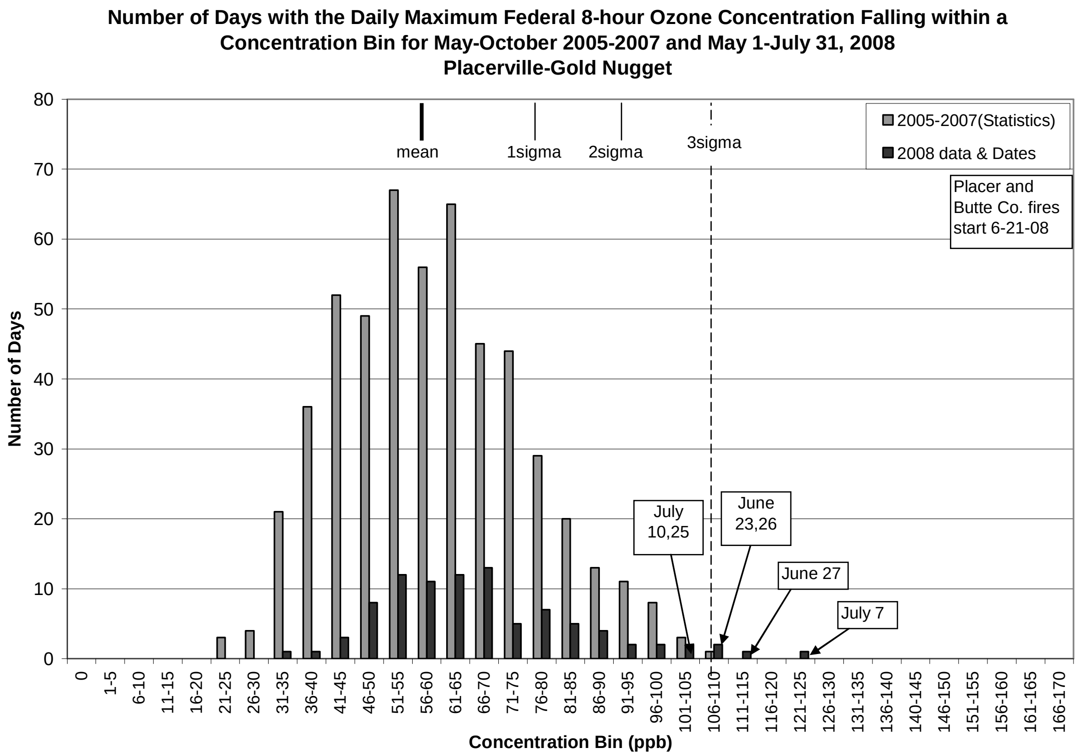
Strengthening onshore winds at Travis Air Force Base (AFB) during the morning of July 27 indicated the onset of the delta breeze, which extended throughout the Sacramento Valley to Redding. As a result, smoke and haze disappeared from most areas, creating clear skies and improving visibility. This brings to a close the third episode of ozone exceedances.

Throughout the rest of July, high pressure dominated northern and central California with moderate onshore winds. According to airport weather observations, Sacramento Valley skies remained clear of smoke, though skies remained smoky and hazy near Yreka. Satellite images indicated clear skies over the Sacramento Valley and trailing smoke plumes to the north and northeast from the Coastal Ranges wildfires.

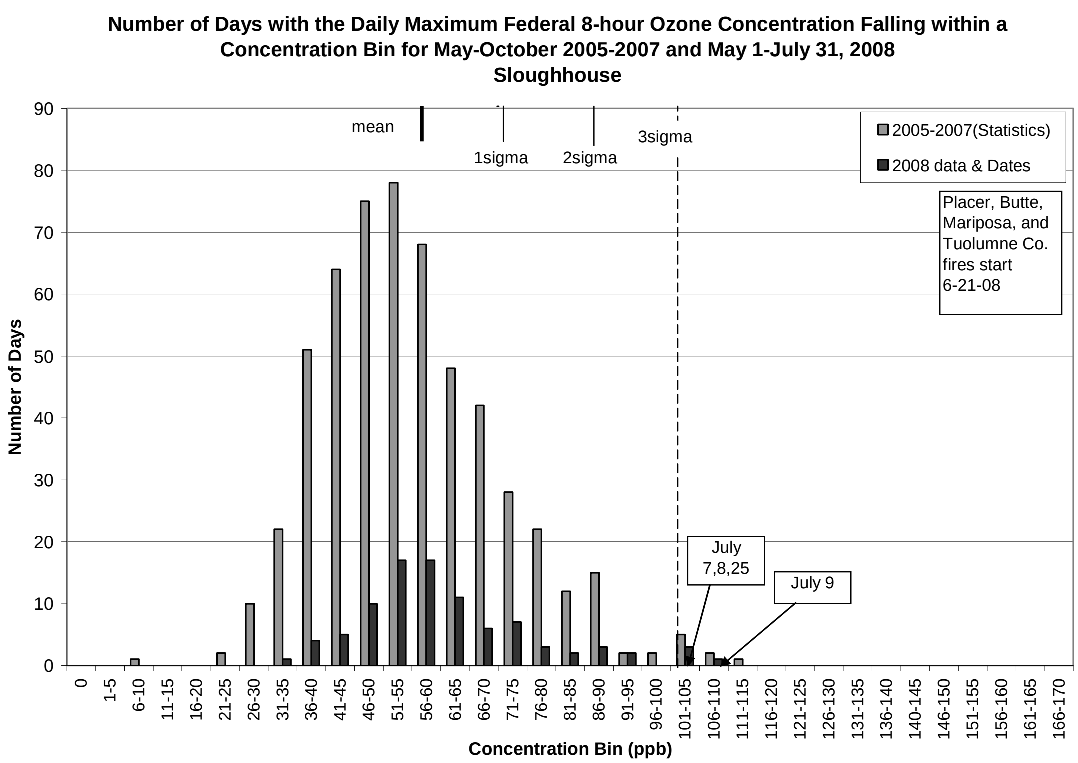
Air Quality Analysis

Graphs 15 and 16 provide a statistical analysis to illustrate that ozone concentrations during the July 24 – 27 ozone episode were significantly above the average of the past three years. Graph 15 represents data from Placerville (El Dorado County) and shows that ozone on June 23, 26, 27, July 7, 10, and 25 were all statistically unlikely to occur. Likewise, Graph 16 shows data from Sloughhouse (Sacramento County) on July 7, 8, 9, and 25 statistically unlikely to occur. These graphs indicate that ozone concentrations seen during this period were not likely occur but for the wildfires.

Graph 15



Graph 16



Public Mitigation

The ARB and the Districts throughout northern California met all of the requirements for mitigating the impacts of these catastrophic wildfires on the public. Numerous health advisories were issued during the period spanning the fires so that the public would minimize their exposure to the unhealthy air. This included media interviews to educate the public on the hazardous air quality conditions. Attached to this document are several examples of public advisories issued by ARB.

Additionally, the Districts and ARB staff investigated emission-generating activities during the two episodes, and found that ozone precursor emissions were approximately constant before, during, and after the event.

Conclusion

The preceding analysis has addressed the criteria as required in the Exceptional Events Rule. In particular, the analysis has shown that:

The event(s) have met the definition of an 'exceptional event' and:

- Affected air quality;
- Was not reasonably controllable or preventable; and
- Was a natural event;

A clear causal relationship was demonstrated between the event (catastrophic wildfires) and the concentration measured at the monitoring site:

- The events were above normal historical fluctuations ; and,
- Reasonable and appropriate actions were taken to protect public health and provide for public comment on the establishment of this event as an 'exceptional' event."

Therefore, based on the weight of evidence provided for in this document, the ozone concentrations that occurred during these periods were significantly influenced by the catastrophic wildfires of summer 2008.

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