EXCEPTIONAL EVENT DEMONSTRATION FOR NOVEMBER 2018 PM_{10} EXCEEDANCES IN SACRAMENTO COUNTY DUE TO WILDFIRES (DRAFT)

FEBRUARY 12, 2021
SACRAMENTO METROPOLITAN
AIR QUALITY MANAGEMENT DISTRICT

On the Cover: Aqua/Terra Satellite image from November 14, 2018 courtesy of NASA. Satellite image shows the extent of the smoke plume generated by the Camp Fire Wildfire.

Inset photo on the cover shows smoke on Interstate 80 in Sacramento County on November 14, 2018. Photo courtesy of Rich Muzzy.

EXCEPTIONAL EVENT DEMONSTRATION

FOR NOVEMBER 2018 PM_{10} EXCEEDANCES

IN SACRAMENTO COUNTY DUE TO WILDFIRES

Prepared by:

Sacramento Metropolitan Air Quality Management District
777 12th Street, Third Floor
Sacramento, CA 95814-1908
(916) 874-4800
http://www.airquality.org

Principal Authors: **Richard Muzzy, Associate Air Quality Planner**
Steven Lau, Associate Air Quality Planner
Stephen D'Andrea, Statistician

Reviewed by: **David Yang, Program Supervisor**
Janice Lam Snyder, Program Manager

Approved by: **Mark Loutzenhiser, Division Manager**
Alberto Ayala, Ph.D., M.S., Executive Director/APCO

Table of Contents

Figures and Tables

Figures

Tables

Executive Summary

The Camp Fire Wildfire (CAMP) was one of the deadliest wildfires in California history and resulted in more than 80 deaths and 17 non-fatal injuries. The CAMP started in Butte County, located in Northern California, about 60 miles north of Sacramento on 11/8/2018 and was not fully contained until 11/25/2018. During this wildfire event, smoke was transported to many counties, including Sacramento County. The monitors in the Sacramento PM_{10} Maintenance Area (Sacramento County) recorded particulate matter with a diameter of 10 microns or less (PM_{10}) concentrations that exceeded the 24-hour PM_{10} National Ambient Air Quality Standards (NAAQS) of 150 $\mu g/m^3$. These PM_{10} exceedances occurred on six days on November 10, 11, 12, 14, 15, and 16 in 2018, and resulted in a violation of the PM_{10} standard for Sacramento County. These are the first exceedances to occur since 2006.

The Sacramento Metropolitan Air Quality Management District (Sac Metro Air District or District) is required to update the PM_{10} Implementation/Maintenance Plan and Redesignation Request for Sacramento County (Sac Metro Air District, 2010) (referred to as First MP) to demonstrate attainment/maintenance of the PM_{10} standard for a second 10-year period. This updated is referred to as the Second 10-year PM_{10} Maintenance Plan (referred to as Second MP) and will be based on a 2017 – 2019 design value. Since the CAMP caused the county to violate the PM_{10} standard based on the 2017 – 2019 design value, the District requests Environmental Protection Agency (EPA) to exclude these exceedances under the EPA's Treatment of Data Influenced by Exceptional Events (Exceptional Event Rule) (81 FR 68216).

This Exceptional Event Demonstration meets the criteria required under the Exceptional Event Rule; it includes a conceptual model of the exceptional event, clear causal relationship between the exceptional event and the exceedances, compares concentrations influenced by the exceptional event to those not influenced by the exceptional event, and provides justification that the event is not reasonably controllable or not reasonably preventable and unlikely to recur at the same location. These criteria provide the weight of evidence to attribute the exceedances to the smoke from the CAMP and demonstrate this exceptional event is the cause of the violations.

To support this demonstration, satellite images for each exceedance day were used to clearly show the presence of a large smoke plume that covered Sacramento County and surrounding counties. A trajectory and meteorology analysis show that the CAMP was the source of the smoke, which was transported to Sacramento County, where the elevated PM_{10} concentrations resulted in many unhealthy air quality days. Air quality advisories, alerts and media reports were released to help inform Sacramento County residents to avoid the smoke during the wildfire event.

The District requests that EPA concurs with the exclusion of PM_{10} concentrations influenced by the CAMP that were above the PM_{10} NAAQS standard from regulatory decisions. With EPA's concurrence, Sacramento County will continue to show attainment of the PM_{10} standard, and the District can move forward with the development and submittal of the Second MP.

1. Introduction

1.1. Overview

The Sacramento Metropolitan Air Quality Management District (Sac Metro Air District or District) is submitting this Exceptional Event Demonstration to the Environmental Protection Agency (EPA) for the days impacted by the Camp Fire Wildfire (CAMP) where the PM_{10} concentrations exceeded the PM_{10} 24-hour National Ambient Air Quality Standard (NAAQS) of 150 µg/m^3. These exceedances occurred in Sacramento County, California, and were a result of smoke impacts from the CAMP on November 10, 11, 12, 14, 15 and 16 in 2018. These are the first exceedances to occur during the PM_{10} Implementation/Maintenance Plan and Redesignation Request for Sacramento County (Sac Metro Air District, 2010) (referred to as First MP), which covered the maintenance period from 2012 through 2023. The District is required to update the First MP to demonstrate attainment/maintenance of the PM_{10} standard for a second 10-year period. This updated is referred to as the Second 10-year PM_{10} Maintenance Plan (referred to as Second MP) and will be based on a 2017 – 2019 design value. The District requests that EPA concurs that these exceedances are due to a wildfire and the associated smoke impacts and should be classified as an exceptional event, consistent with EPA's definition of "unusual or naturally occurring events that can affect air quality but are not reasonably controllable using techniques that tribal, state or local air agencies may implement in order to attain and maintain the [NAAQS]" (USEPA, 2020a).

1.2. PM_{10} 24-Hour Standard

On July 1, 1987, EPA revised the NAAQS for particulate matter with a new PM_{10} indicator as the basis for the standards (52 FR 24634). The level of the federal PM_{10} standards was set at 150 µg/m^3 for a 24-hour average concentration and 50 µg/m^3 for an annual average concentration. In 1997 and 2006, EPA reviewed and retained the PM_{10} standard (62 FR 38652; 71 FR 61198). An exceedance occurs when there is a 24-hour averaged PM_{10} concentration greater than 150 µg/m^3 at a monitoring site. A violation occurs if the number of 24-hour NAAQS exceedance days are greater than 1.0 averaged over 3 consecutive years of representative data (40 CFR 50, Appendix K, 2.1(a)).

1.3. Clean Air Act Requirements

Nonattainment Designation

Upon enactment of the 1990 Clean Air Act (CAA) Amendments, Sacramento County was designated as unclassifiable for PM_{10} pursuant to Section 107(d)(4)(B)(iii) of the Clean Air Act. However, during 1989 and 1990, two PM_{10} monitors in Sacramento County violated the 24-hour PM_{10} standard. On January 20, 1994, EPA took final action to redesignate Sacramento County as a "moderate" nonattainment area for the PM_{10} NAAQS (58 FR 67334) with an attainment deadline of December 31, 2000.

EPA Approval of PM_{10} Implementation and Maintenance Plan

In 2002, EPA determined that Sacramento County attained the PM_{10} 24-hour NAAQS by the attainment deadline based on data from 1998 - 2000 (67 FR 7082). The Sac Metro Air District submitted the First MP to EPA showing how the region attained the PM_{10} NAAQS and requested

that EPA redesignate Sacramento County from nonattainment to attainment (Sac Metro Air District), 2010). EPA approved the First MP on September 26, 2013, which became effective on October 28, 2013 (78 FR 59261).

Development of Second 10-year PM_{10} Maintenance Plan

The Sac Metro Air District is required to develop a Second MP to address and document the continued maintenance of the PM_{10} NAAQS for a second 10- year period beyond the original 10-year period, which will end in 2023. Clean Air Act (CAA) Section 175A(b) requires the submittal of the Second MP, 8 years after the effective date of the First MP. The second ten-year period will cover the period from 2024 through 2033 and will be based on a design value from 2017 – 2019. Because the data used to calculate the design value includes exceedances which were a result of an exceptional event, an Exceptional Event Demonstration was done. To ensure coordination with the agencies involved in this process, the Sac Metro Air District:

- Submitted an Exceptional Event Initial Notification Summary to the California Air Resources Board (CARB) in August 2019, which identified the data that needed to be flagged[1]. CARB then forwarded the Exceptional Event Initial Notification Summary to EPA.
- Discussed with EPA and CARB in December 2019 and January 2020 the regulatory significance for the exclusion of the data.
- Received concurrence from EPA Region IX in a letter dated March 3, 2020 to CARB to move forward with the development of the Exceptional Events demonstration. EPA Region IX stated that this demonstration was necessary because the District will be submitting the Second MP based on the 2019 design value (using data from calendar years 2017-2019). To show that the 2019 design value met the PM_{10} standard, the District would need to exclude the data identified in the Initial Notification Summary.

1.4. Exceptional Event Rule Requirements

EPA's Treatment of Data Influenced by Exceptional Events (Exceptional Event Rule) (81 FR 68216) provides the requirements that air agencies must meet when requesting EPA to exclude exceptional event-related concentrations from regulatory determinations.

The following are requirements under 40 CFR 50.14(c)(3)(iv)(A–E):

A. A narrative conceptual model that describes the event(s) causing the exceedance or violation and a discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s);
B. A demonstration that the event affected air quality in such a way that there exists a clear causal relationship between the specific event and the monitored exceedance or violation;
C. Analyses comparing the claimed event-influenced concentration(s) to concentrations at the same monitoring site at other times to support the requirement in paragraph (c)(3)(iv)(B) of this section. The Administrator shall not require a State to prove a specific percentile point in the distribution of data;

[1] The Maintenance Contingency Plan (Sac Metro Air District, 2010, Section 7.3, page 7-2) of the first 10-year PM_{10} maintenance Plan requires that after verification of a monitoring violation of the PM_{10} NAAQS that first, the Sac Metro Air District will examine the event and determine if it needs to be classified as a natural or exceptional event in accordance with EPA requirements.

D. A demonstration that the event was both not reasonably controllable and not reasonably preventable; and
E. A demonstration that the event was a human activity that is unlikely to recur at a location or was a natural event.

This demonstration addresses the above requirements in showing that the wildfire smoke from the CAMP caused the PM_{10} exceedances in Sacramento County. In addition, the District will provide public notification and allow the opportunity for the public to provide comments on this demonstration. The public notice period will be opened for 30 days.

1.5. Exceedances

All four PM_{10} monitoring stations in Sacramento County exceeded the 24-hour standard during the CAMP event. The fire started in Butte County, about 60 miles north of Sacramento County on November 8, 2018, and was contained on November 25, 2018. The CAMP produced heavy smoke, and the strong upper-level ridge[2], coupled with strong winds, low humidity, warm and dry conditions caused rapid wildfire growth and transported wildfire smoke into Sacramento County.

Table 1-1 shows the number of PM_{10} exceedances that occurred during the most recent 5-year period from 2015 – 2019.

Table 1-1 Number of PM_{10} Exceedances (24-hour concentrations greater than 150 µg/m^3)

	2015	2016	2017	2018	2019	Sampling Frequency
Sacramento T Street	0	0	0	6	1	Every 24 hours
North Highlands	0	0	0	12	0	1 in 6 days**
Del Paso Manor (Primary Monitor)*	0	0	0	12	0	1 in 6 days**
Del Paso Manor (Secondary Monitor)*	0	0	0	12	0	1 in 6 days**
Sacramento Branch Center	0	0	0	6	0	1 in 6 days**

Notes: * Del Paso Manor has co-located monitors (primary and secondary), so although there were four exceedances, the exceedances occurred on two (not four) days, on 11/10/18 and 11/16/18, at both monitors.
** For monitors where sampling is done 1 in 6 days, each exceedance counts as 6 occurrences.

Not all days during the CAMP event recorded PM_{10} concentrations above the PM_{10} NAAQS, but all days showed abnormally high PM_{10} concentrations, which indicated that smoke was transported and widespread throughout the region.

1.6. Action Requested

Table 1-2 shows that the design value[3] for 2017 to 2019 at all four monitoring stations in Sacramento County are above 1.0. The District requests EPA concurrence with this Exceptional Event

[2] Upper level ridge is an elongated area of relatively high pressure, at a constant altitude, in the atmosphere. Upper level ridges are often oriented north-south, alternating between upper level troughs, however, during summer they may assume random orientations and vast dimensions. (National Wildfire Coordinating Group, 2020)

[3] The PM_{10} design value is the 3-year average of the number of exceedance days for a monitoring station. Since majority of the PM_{10} monitors are not in daily schedule, a multiplication factor is applied to extrapolate the number of exceedance day. The

Demonstration, so the data impacted by the 2018 CAMP will be excluded from the 2017 - 2019 design value calculations, and the county will be below the three-year average of 1.0, which is required to demonstrate attainment of the PM_{10} standard.

Table 1-2 2017 to 2019 PM_{10} NAAQS design values with and without wildfire influenced exceedances in Sacramento County

Monitoring Stations	DV without wildfire influenced exceedance	DV with wildfire influenced exceedance
North Highlands (06-067-0002-2)	4.1	0
Del Paso Manor (06-067-0006-1)	4.1	0
Del Paso Manor (06-067-0006-2)	4.1	0
Sacramento T Street (06-067-0010-4)	2.3	0.3
Branch Center (06-067-0284-1)	2	0

Note: This Table includes the one exceedance that occurred at Sacramento T-Street in October 2019. This single exceedance was probably caused by an exceptional event, potentially caused by high wind dust as well as potential smoke, and will have no regulatory impact provided the exceedances in this exceptional event analysis are approved. Therefore, no exceptional event demonstration will be done for this exceedance at this time but may be conducted in the future if there is regulatory significance.

This demonstration includes all elements and meets all requirements identified by the Exceptional Event Rule.

factor is the number of calendar days divided by the number of sampling days in a quarter. The extrapolated four quarterly exceedance days are summed together for the annual number of exceedance day. The sum of 3-year number of exceedance days then divided by 3 for the design value. The detailed calculation and example are described in 40 CFR 50 Appendix K.

2. Monitoring Network

2.1. Overview of Sacramento's Ambient Air Monitoring Network

Sacramento County, shown in Figure 2-1, is the PM_{10} Maintenance Area boundary. Figure 2-1 and Table 2-1 show there are a total of seven monitoring stations in Sacramento County that have FRM (Federal Reference Method) or FEM (Federal Equivalent Method) compatible equipment to monitor particulate matter ($PM_{2.5}$ and/or PM_{10}) as of October 2020. The four monitoring stations that monitor for PM_{10}, highlighted in yellow in Table 2-1, are operated by either Sac Metro Air District or California Air Resources Board (CARB). Each monitor, shown below, is discussed in the District's 2020 Annual Network Plan (Sac Metro Air District, 2020a) or CARB's Annual Network Plan (CARB, 2020). Monitoring stations located outside of the Sacramento County boundaries are shown in Figure 4-2 (Geographic Extent of Monitoring Network).

Figure 2-1 Sacramento County Monitoring Location Map

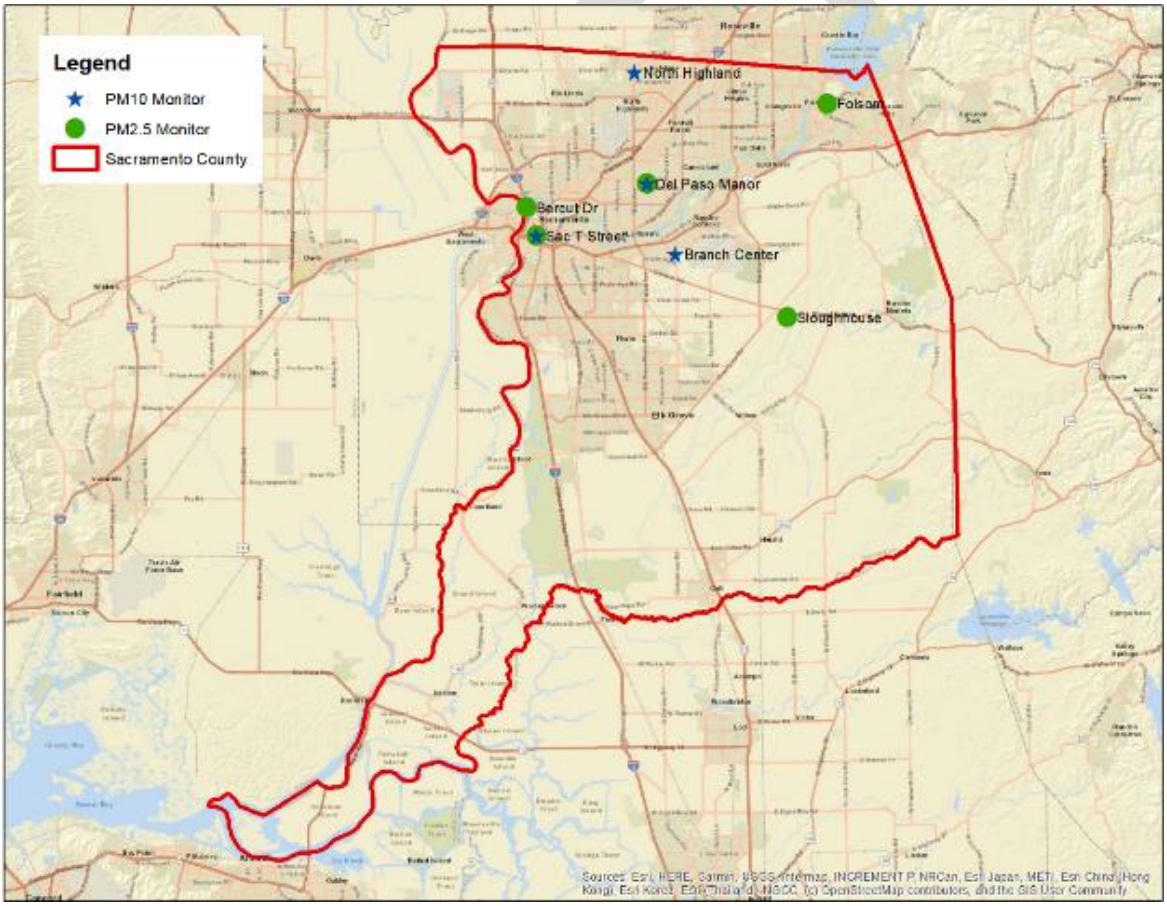


Table 2-1 Monitoring Stations and Particulate Matter Concentrations Monitored in Sacramento County

Monitor	PM_{10}	$PM_{2.5}$
Bercut Dr.		✓
Branch Center	✓	
Del Paso Manor	✓	✓
Folsom-Natoma St.		✓
North Highlands Way	✓	
Sloughhouse		✓
T Street	✓	✓

Note: Monitoring stations highlighted in yellow are where PM_{10} exceedances occurred and are described in more detail below.

Each active PM_{10} monitoring site in Sacramento County is described below:

- T Street - The T Street monitoring station is operated by CARB. This station uses a Beta Attenuation Monitor, which supports the Federal Equivalent Method. Sampling frequency is continuous and PM_{10} values are recorded hourly. This station has been operational since December 1, 1998 and is located at an elevation of 15 meters.
- North Highlands - The North Highlands monitoring station is operated by Sac Metro Air District. This station uses a High-Volume Monitor air sampler, which supports the Federal Reference Method. Sampling frequency is 1 in 6 days. This station has been operational since January 1, 1980 and is located at -an elevation of 33 meters.
- Del Paso Manor - The Del Paso Manor monitoring site has two PM_{10} monitoring stations (a primary monitor and an audit monitor), which are operated by Sac Metro Air District. This station uses High Volume Monitor air samplers, which support the Federal Reference Method. Sampling frequency is 1 in 6 days. This station has been operational since January 1, 1980 and is located at an elevation of 30 meters.
- Branch Center - The Branch Center monitoring station is operated by Sac Metro Air District. This station uses a High-Volume Monitor air sampler, which supports the Federal Reference Method. Sampling frequency is 1 in 6 days. This station has been operational since April 1, 2006 and is located at an elevation of 23 meters.

3. Conceptual Model

The Exceptional Event Rule requires that a narrative conceptual model be developed, which describes the event(s) causing the exceedances or violations and a discussion of how emissions from the event(s) led to the exceedances or violations at the affected monitors. This section will describe the event, Camp Fire Wildfire (CAMP), and the general meteorological conditions, which caused the wildfire to spread so quickly and produce smoke that elevated the air quality concentrations well above normal conditions in Sacramento County.

3.1. Camp Fire Wildfire

Overview

The CAMP started on November 8, 2018 and was not fully contained until November 25, 2018. Figure 3-1 shows that the fire started in Butte County, about 60 miles north of Sacramento County. Up to that date, this wildfire was one of the deadliest and most destructive wildfires in the recorded California history. Figure 3-2 shows the vast destruction of the fire, which burned approximately 153,336 acres (nearly 240 square miles). The fire also consumed most of the 27,000-person town of Paradise and destroyed almost 19,000 structures (Simon, 2018a). California Department of Forestry and Fire Protection (CalFire) said that CAMP was caused by electrical transmission lines failure. According to Cal Fire, the combination of the warm conditions and the windy weather contributed to the quick spread of the wildfire. CalFire said, "…the tinder-dry vegetation and Red Flag conditions consisting of strong winds, low humidity, and warm temperatures promoted this fire and caused extreme rates of spread…" (CalFire, 2019).

Figure 3-1 Camp Fire General Location Map

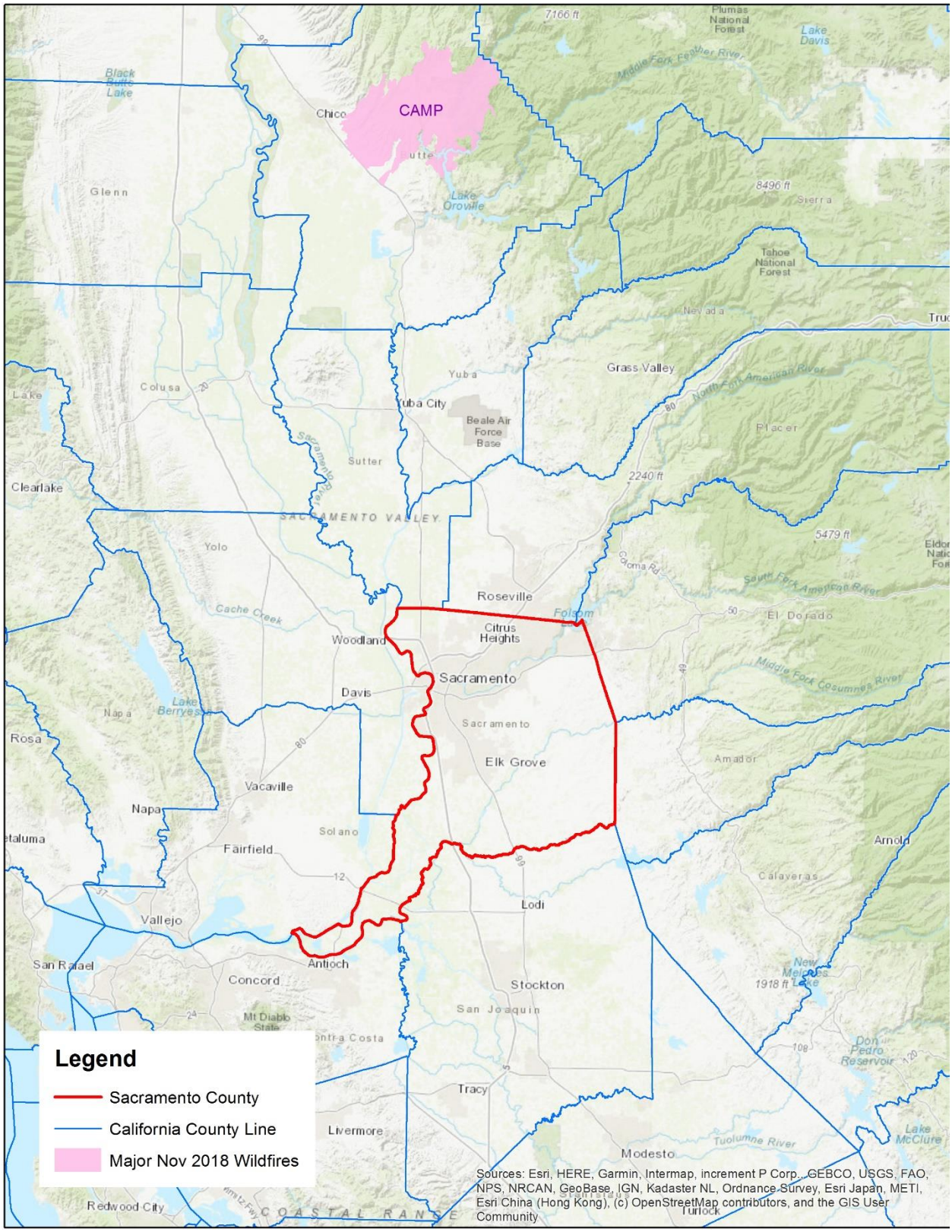
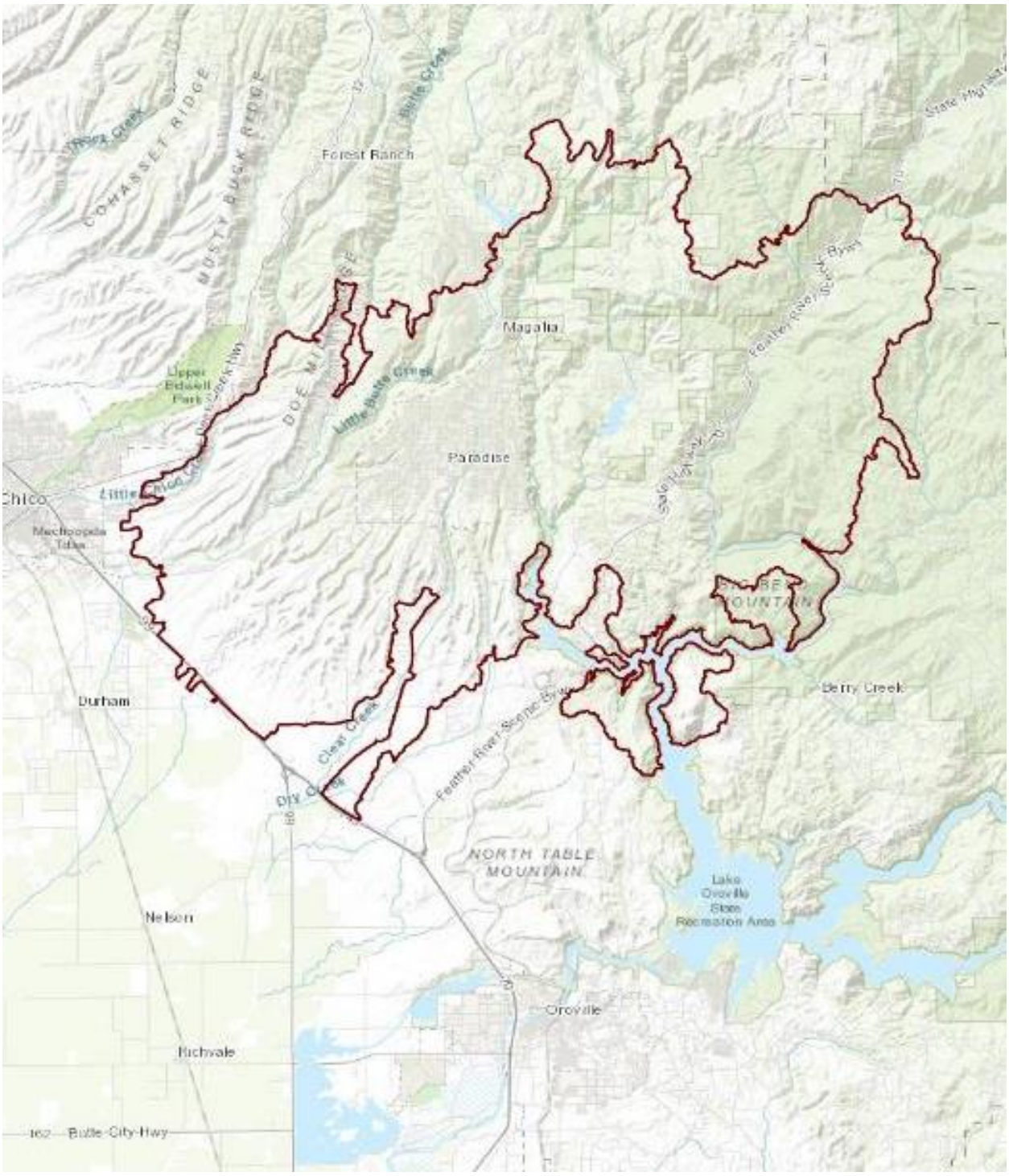


Figure 3-2 Camp Fire Boundary Map



Meteorological and Climatological Conditions

The summer of 2018 was much "warmer than average" across California (Figure 3-3). Northern California experienced below average to record low precipitation totals during the fall of 2018 (Figure 3-4). The warmer weather and lower precipitation led to ground moisture being very low heading into November 2018, providing significant wildfire fuel. "Precipitation across much of the

state was less than 5 percent of average in September [2018], and the summer dry signal extended into beginning of the fall wet season, with below-average precipitation in October [2018] as well" (NOAA, 2018). The town of Paradise, which usually averaged 4.04 inches of rain during the period of August through October, received only one-seventh of an inch during this same period in 2018 (and no rain before the fire in November) (NWS, 2020a; Boxall, 2018; Lin et al, 2018). News media accounts of the wildfire are discussed in Appendix A.

On November 8, 2018, the day the CAMP ignited, the National Weather Service (NWS) issued a Red Flag Warning throughout California because the meteorological conditions were favorable to extreme fire behaviors if a fire started. Unfortunately, several fires ignited around the state that day, including the CAMP in Northern California and Woosley Fire in Southern California.

The CAMP was driven by a strong easterly downslope wind, which tends to be strong at this time of year due to the proximity to mountainous regions, associated drainage canyons, and strength of the jet stream. North and south "meanders" in the jet stream, known as troughs and ridges, can be amplified with a stronger jet stream. Cold air masses travel through the Great Basin in Nevada and at times, can spill over the Sierra Nevada Mountains in eastern California. Large amplitude meanders can produce large areas of high pressure, which can, at times, accelerate winds. The extremely strong winds further desiccated already dry vegetation and advanced the fires with incredible speed.

The Feather River Canyon, where the CAMP began, was well-known for high winds. On the morning of the CAMP, wind speeds as high as 72 miles per hour were recorded (Meigs, 2018). Rather than spreading as a flame on the ground, the CAMP became wind-borne spreading the fire through branches and embers in the air. These embers fell on trees and brush stressed by several years of drought, as well as thick grass, which had since dried out completely after dense growth during heavy spring rains (Simon, 2018b).

Brewer and Clements (2019) described the meteorological conditions, which enhanced the downslope wind event during the CAMP.

> "[T]his event was associated with mid-level anti-cyclonic Rossby wave breaking likely caused by cold air advection aloft. An inverted surface trough over central California created a pressure gradient, which likely enhanced the downslope winds. Sustained surface winds between 3–6 m s^{-1} [7–13 mph] were observed with gusts of over 25 m s^{-1} [56 mph] while winds above the surface were associated with an intermittent low-level jet. The meteorological conditions of the event were well forecasted, and the severity of the fire was not surprising given the fire danger potential for that day".

Another impact of the strong and gusty downslope winds is that the subsiding air heated up and dried out rapidly, further dehydrating the already extremely dry fuel in the region. As the downslope winds accelerated the fire grew with wind and decreasing humidity. The fire itself began to produce its own wind due to the extreme temperature gradients and further accelerated the growth of CAMP (Brewer and Clements, 2019).

Fire Progression and Smoke Impacts

In the first week (11/8/2018 – 11/15/2018), the fire burned tens of thousands of acres per day — up to about 4,600 acres an hour (Cal Fire, 2018). State fire officials called the speed of the fire unprecedented. In the second week (11/16/18 – 11/23/18), the fire expanded by several thousand acres per day along a large uncontained fire line. According to the Cal Fire Incident Update (Cal Fire, 2018), the fire burned 146,000 acres and was 40% contained by November 16, 2018. Most of spread of the fire was along the uncontained eastern half.

As the CAMP burned, it generated smoke, and heavy gusts transported the smoke into downwind communities, including communities in Sacramento County.The CAMP was positioned for north-easterly winds pushing the smoke into Sacramento County and beyond into San Francisco Bay Area. The smoke as identified in satellite images shown in Figure 4-3 (a-g) covered a large portion of heavily populated areas in Northern California. The smoke from CAMP hung over the Sacramento region during this time. Recorded PM_{10} levels in the Sacramento region were unhealthy according to the Spare the Air website for the Sacramento region from November 10 to November 16 (see Appendix B).

Table 3-1 shows the number of acres burned, percent contained and excerpts from the National Weather Service Area Forecast Discussions from November 8 to November 16, 2018. The excerpts describe the strong winds, dry vegetation, and low humidity, which produced critical fire conditions and caused the transport of heavy smoke into Sacramento County. At times, light winds and strong temperature inversions in Sacramento County forced the dense smoke plume to settle at ground level, causing poor visibility and hazardous particulate matter concentrations. “The inversion traps smoke at lower levels, and that's where you can really get some communities that are smoked in with some very unhealthy air quality, especially in areas that are directly downstream or in the vicinity of the fires.” (Simon, 2018a)

The spatial extent of the smoke from CAMP was vast. The NASA/NOAA Cloud-Aerosol Lidar and Infrared Pathfinder (CALIPSO) satellite used its space-borne lidar to profile the smoke. For example, on November 10, smoke layers were observed at the ground between 0-2 km near the San Francisco Bay Area while elevated plumes up to 3-4 km were observed well offshore of Mexico over the Pacific Ocean (NASA, 2018).

Figures 3-5 (a-g) show Surface Analysis Weather Maps for November 11-13 and November 15 - 17[4] (November 10 - 12 and November 14 - 16 16:00 Pacific Standard Time (PST) from the National Weather Service Weather Prediction Center) (NWS WPC, 2020). The maps illustrate the state of the atmosphere during the period. The pressure analysis shows persistent weak pressure gradients over much of California, which caused stagnant conditions for much of the state throughout the period[5]. From the analysis, there is no frontal activity across California, which would produce wind and precipitation that could reduce smoke concentrations. The conditions shown in the maps were consistent with persistent heavy smoke production from CAMP and increasing concentrations throughout the Sacramento and Central Valleys as the smoke remained near the source or was slowly transported southward from the fire. Surface observations confirm

[4] Maps are issued based on Greenwich Mean Time (GMT)

[5] Pressure lines, or isobars, indicate lines of constant pressure. Isobars which are far apart indicate weak pressure gradients (and therefore weak pressure gradient forces) which generally produce synoptic scale calm and stagnant surface conditions. However, terrain and other microscale features can cause local perturbations in wind.

these conditions as well as the previously mentioned climatological conditions, with calm or light northerly winds, obscured visibility, relatively warm temperatures for November, and significant dew point depressions[6].

Table 3-1 Camp Fire Containment and National Weather Service Forecasts

Date	Fire Burned (acres)	Percent Contained	Excerpts from National Weather Service Area Forecast Discussion (Issued by National Weather Service, Sacramento, CA; times in PST)
11/08/2018	Ignition – 20,000	0%	Downslope wind is producing a significant lowering in humidity with critical fire weather conditions existing across portions of interior NorCal (3:25 am). Large fire started this morning in Butte county with gusty winds (sites reported 50 mph wind gusts) and very low humidity (10% to 20%). Supported by record low [precipitable water] values reported at Oakland (3:15 pm).
11/09/2018	70,000	5 %	Local wind gusts of 35 to 50 mph are occurring over ridges and through favorably oriented canyons of the eastern foothills and mountains. Humidity remains very low today (3:50 am). Strong winds pushed the fire to the south and southwest overnight, spreading smoke over the Sacramento Valley (3:22 pm).
11/10/2018	100,000	20%	Wildfire smoke from the Camp Fire kept temperatures cooler over a significant portion of the area on Friday (11/9) due to blocking some heating by the sun. Gusts up to 15 mph are possible over the northern Sacramento Valley late this afternoon. Winds on the west side of the Sacramento Valley may gust to 25-30 mph (4:08 am). Latest satellite imagery reveals widespread smoke and haze enveloping interior NorCal due to the Camp Fire. A similar type of smoke plume is possible again on Sunday (11/11). Periods of dense smoke will be possible across the Valley for the next few days, although it`ll be difficult to determine breaks in smoke (4:23 pm).
11/11/2018	No Data Available	No Data Available	Light winds and a strong inversion have brought dense smoke to ground level, bringing poor visibility and bad air quality (3:52 am). Widespread smoke and haze continue to envelop the region due to the Camp Fire, with poor visibility for some spots, and bad air quality. Latest smoke forecast indicates smoke continuing to impact the region mainly from Chico southward (3:45 pm).
11/12/2018	117,000	30%	Diminishing winds ease critical fire weather conditions today, but widespread smoke from the Camp Fire will continue to impact the area (10:40 am). Persistent upper ridging over Norcal will result in light/lighter winds over Norcal and limited mixing heights (1 kft - 1.5 kft), will tend to keep persistent smoke over a large portion of the County (Sacramento) Wide Area for the next couple of days (2:25 pm).
11/14/2018	No Data Available	No Data Available	Infrared imagery still shows considerable heat emanating from the Camp Fire, particularly the northeast corner of the fire along the Butte/Plumas boundary (3:33 am). Smoke will likely continue to be an issue in parts of the valley with no strong wind to scour things out in the near term (1:37 pm).

[6] The difference in degrees between the air temperature and the dew point temperature. Large dew point depressions indicate dry ambient air.

Date	Fire Burned (acres)	Percent Contained	Excerpts from National Weather Service Area Forecast Discussion (Issued by National Weather Service, Sacramento, CA; times in PST)
11/15/2018	140,000	40%	Exception to above normal temperatures will be in areas of heavy smoke from the Camp Fire roughly from Chico to Sacramento. Insolation from smoke in these valley locations will keep daytime highs over the next couple of days close to normal for this time of year. Other impact of this wildfire smoke will be decreased visibilities throughout the central valley impacting aviation (3:41 am).
11/16/208	146,000	No Data Available	High pressure ridge over the region is continuing pattern of light winds, smoke with poor visibility and air quality for much of the area. Heavy smoke due to the Camp Fire. Breezy northeasterly winds over the Sierra Nevada Saturday night into Sunday bringing critical fire conditions (3:49 pm)
11/25/2018	End - 154,000	100%	

Note: National Weather Service issues multiple forecast discussions each day – the time each discussion was issued is in parenthesis.

Figure 3-3 County average temperature ranks for June-August 2018 over the period 1895-2018 (NOAA, 2018)

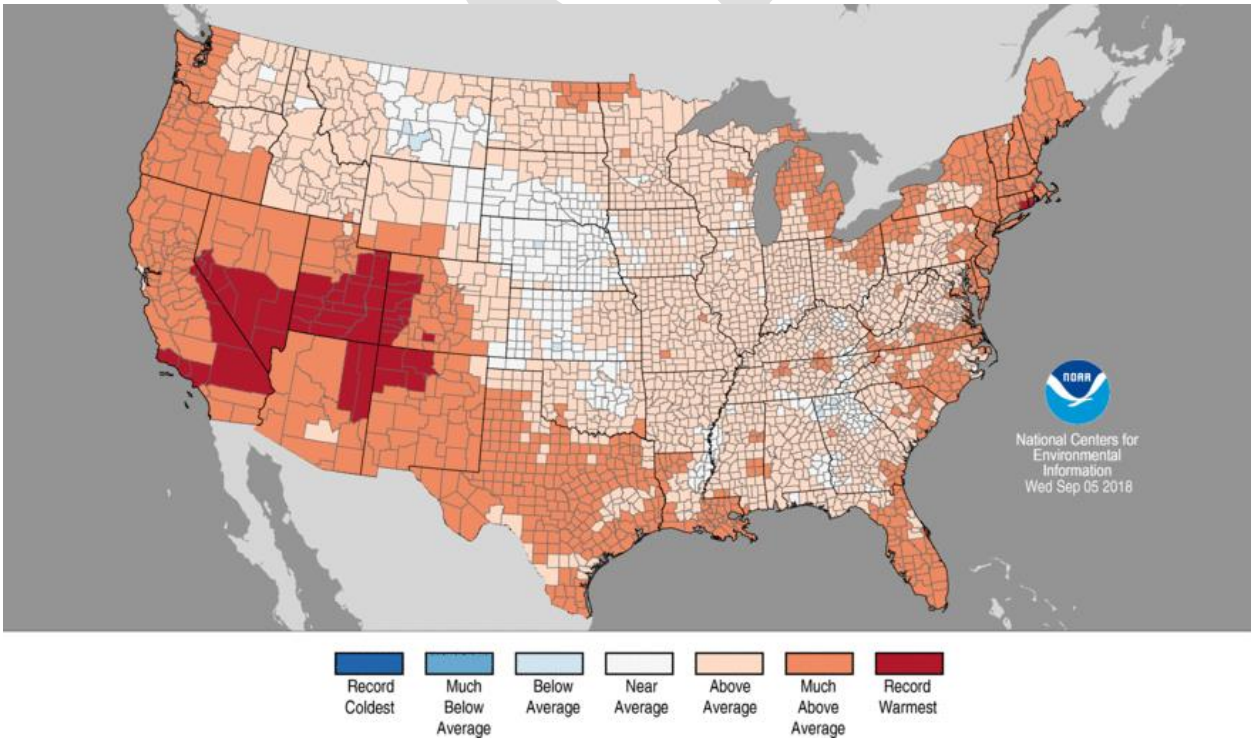
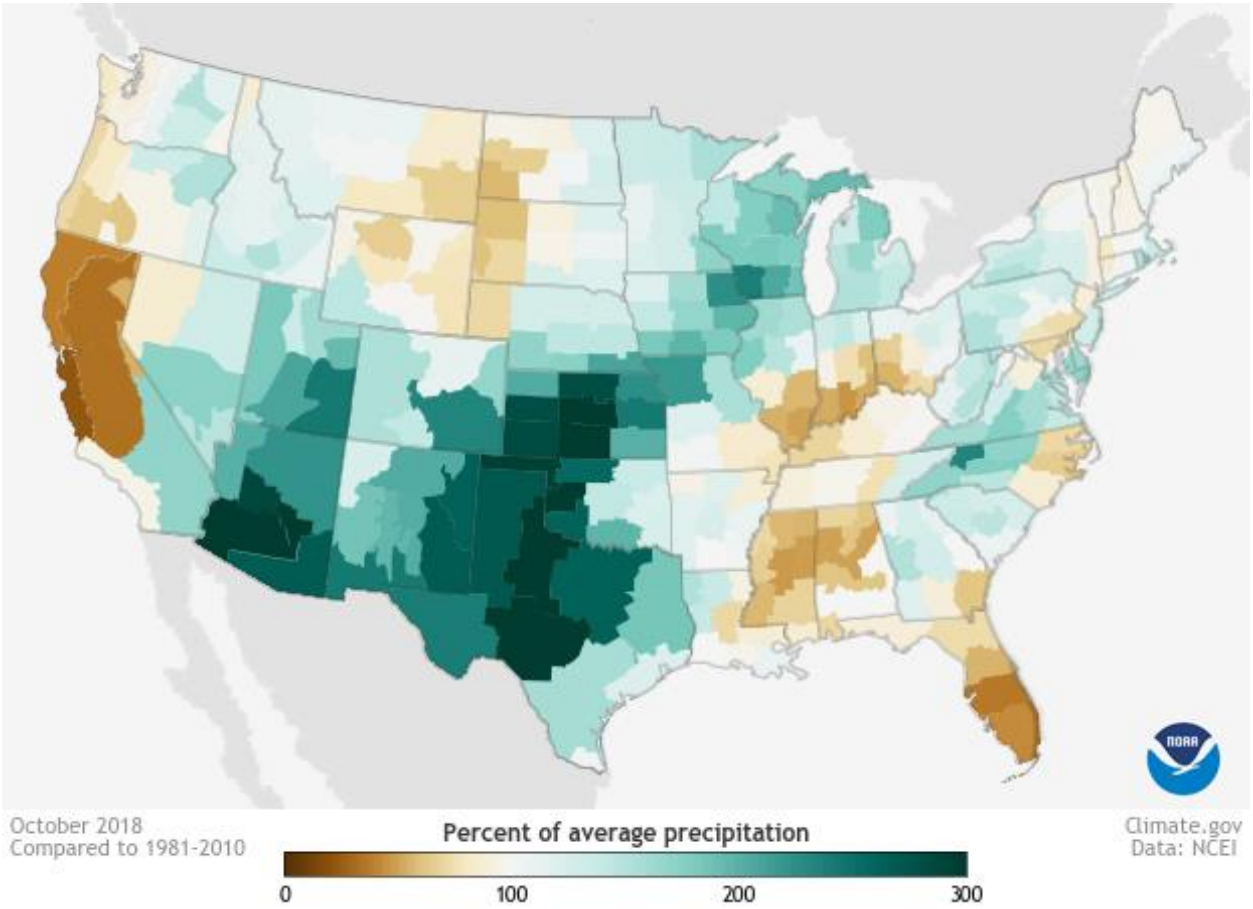


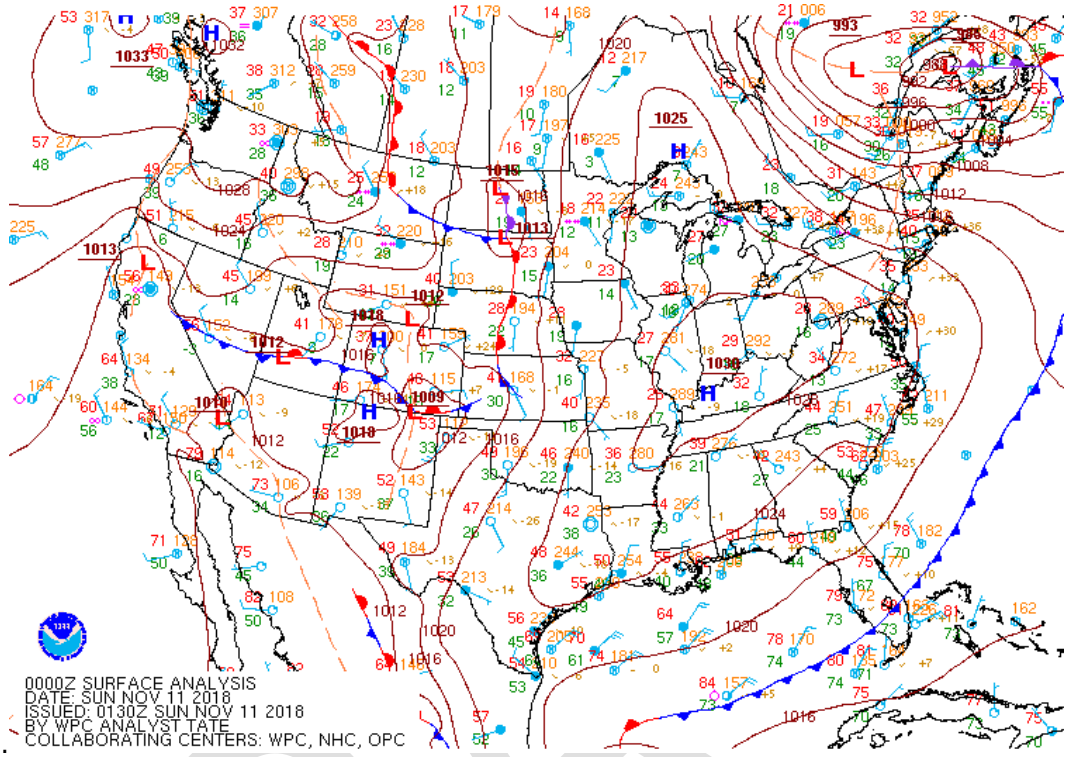
Figure 3-4 Percent of normal monthly precipitation for October 2018 across the United States



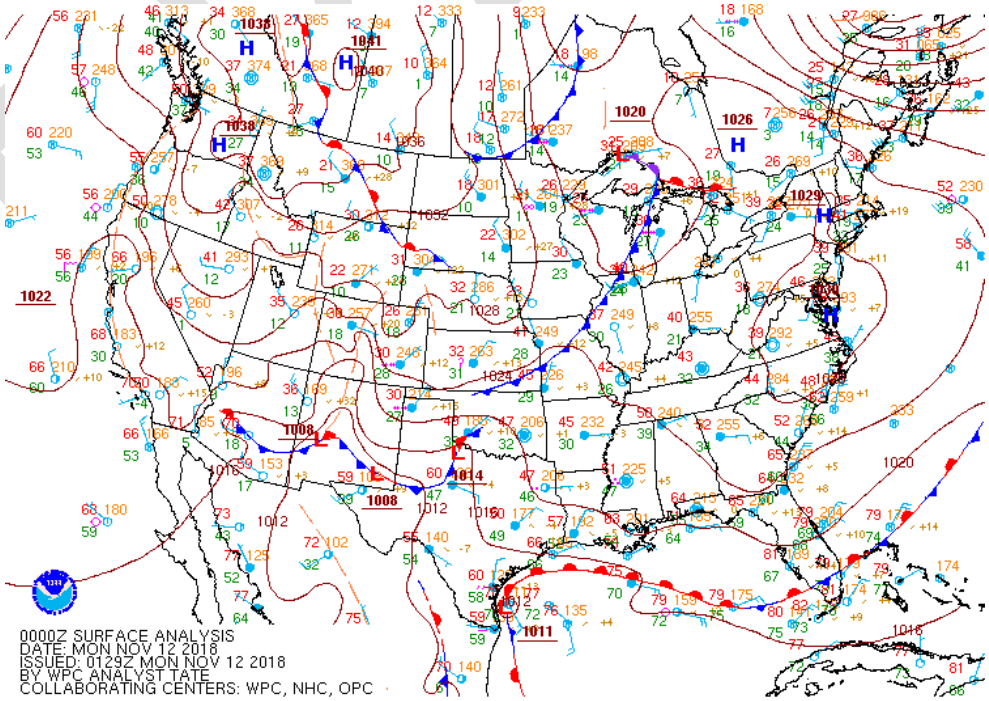
Note: Brown colors reflect drier than average conditions while blues represent wetter than average amounts. Below-average precipitation in California marked a slow start to seasonal rains in the state. Climate.gov image using data from the National Centers for Environmental Information. (Di Liberto, 2018)

Figure 3-5(a – f) National Weather Service Weather Prediction Center (November 11 - 13, 2018 and November 15 - 17, 2018) CONUS Surface Analysis (NWS, 2020b)

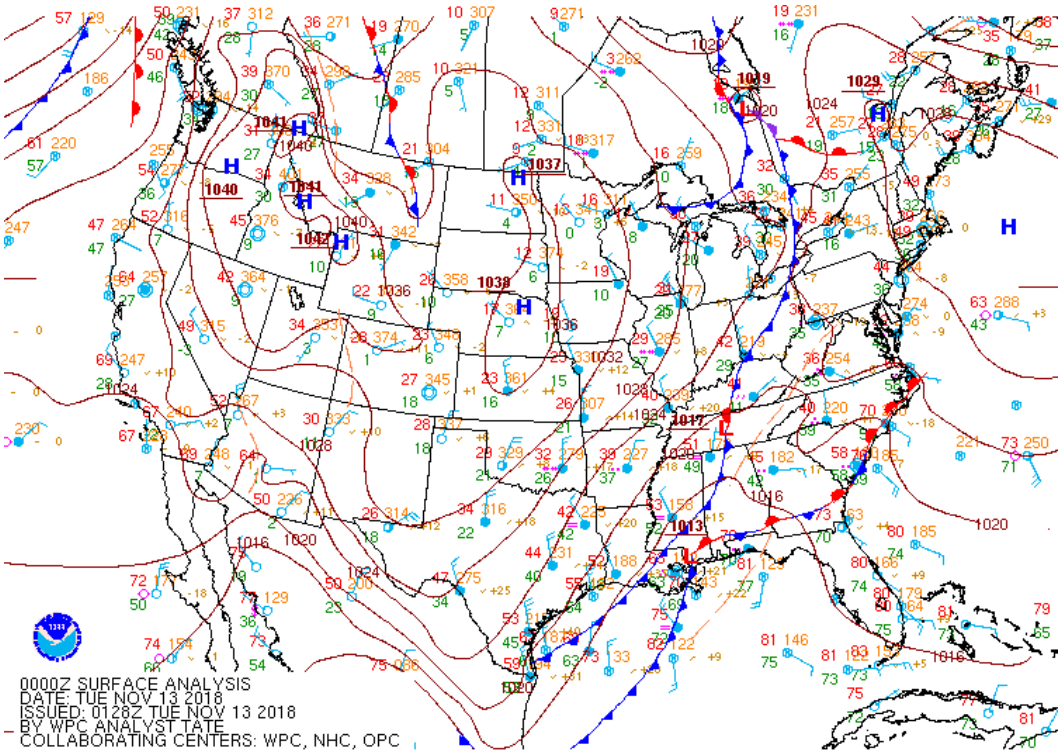
a. November 11, 2018



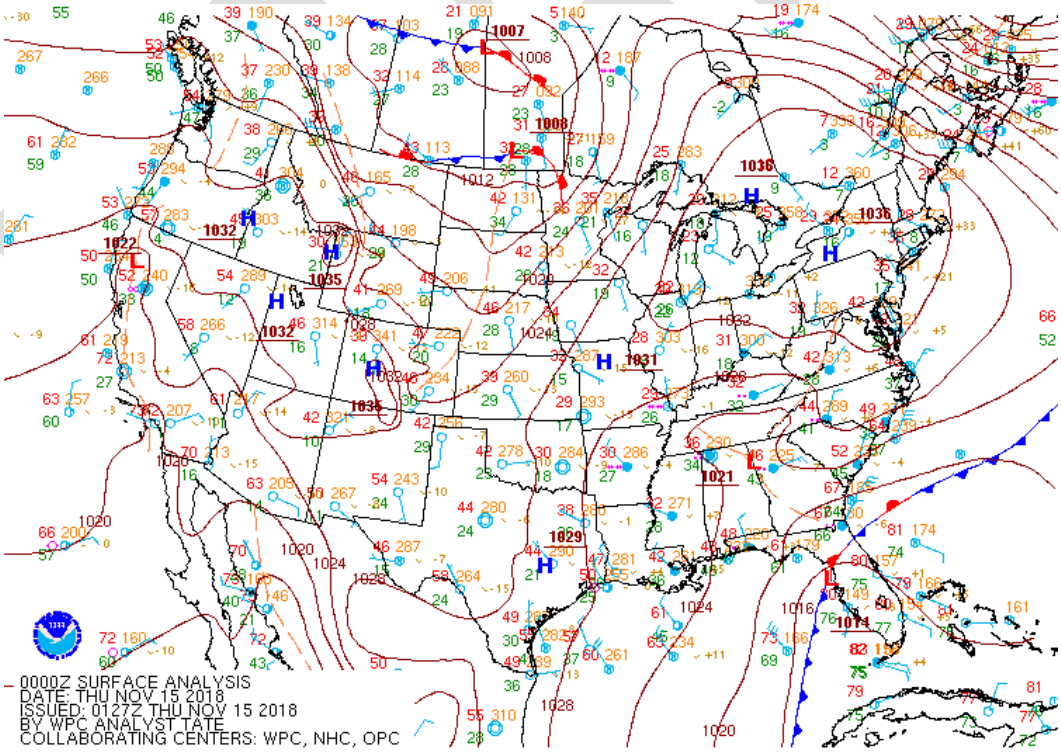
b. November 12, 2018



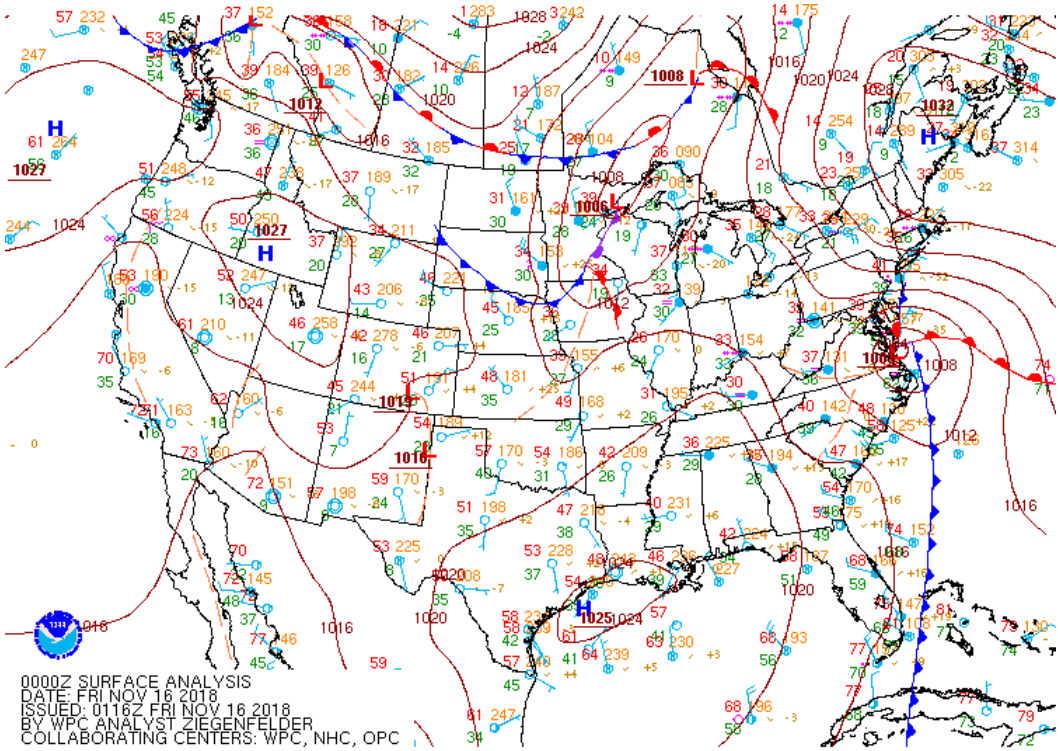
c. November 13, 2018



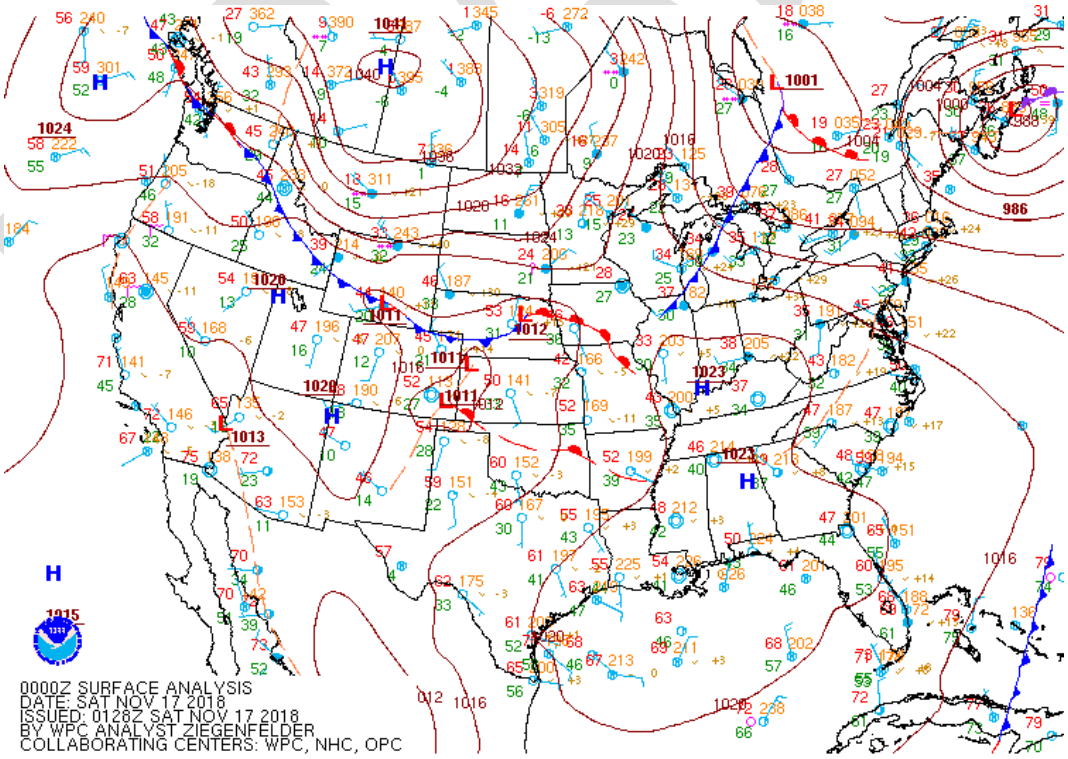
d. November 15, 2018



e. November 16, 2018



f. November 17, 2018



3.2. Affected Region

The smoke impacts from the CAMP extended north-south from the Sacramento Valley in northern California to the Central Valley, and east-west from the Sierra Nevada foothills to the San Francisco Bay Area. Although the smoke impacted many counties, for the purpose of this demonstration, the affected region is Sacramento County, which represents the boundary of the PM_{10} Maintenance Area.

Monitors Impacted

Table 3-2 shows the highest concentrations recorded between the years 2015 - 2019. Thirteen of the fourteen highest concentrations were recorded during the CAMP event. This exceptional event demonstration was completed for six days in 2018 (November 10, 11, 12, 14, 15 and 16) shown in Table 3-2. The exceedance that occurred on October 27, 2019 was not attributed to the CAMP; therefore, it was not included as part of this analysis. EPA's concurrence of the six days attributed to the CAMP event will result in a 2019 design value of less than one, which would allow the area to demonstrate maintenance of the PM_{10} standard.

Table 3-2 Monitoring Date Exceedances (2015 – 2019)

At Date of Event	Site AQS ID / POC	Site Name	Exceedance Concentration (with units)	Rank
11/10/2018	06-067-0010-4	Sacramento T Street	189 µg/m^3	7th
11/10/2018	06-067-0002-1	North Highlands	222 µg/m^3	3rd
11/10/2018	06-067-0006-2	Del Paso Manor (Audit Monitor)	202 µg/m^3	5th
11/10/2018	06-067-0006-1	Del Paso Manor (Primary Monitor)	212 µg/m^3	4th
11/10/2018	06-067-0284-1	Sacramento – Branch Center	200 µg/m^3	6th
11/11/2018	06-067-0010-4	Sacramento T Street	176 µg/m^3	10th
11/12/2018	06-067-0010-4	Sacramento T Street	183 µg/m^3	8th
11/14/2018	06-067-0010-4	Sacramento T Street	181 µg/m^3	9th
11/15/2018	06-067-0010-4	Sacramento T Street	292 µg/m^3	1st
11/16/2018	06-067-0010-4	Sacramento T Street	252 µg/m^3	2nd
11/16/2018*	06-067-0002-1	North Highlands	163 µg/m^3	13th
11/16/2018	06-067-0006-1	Del Paso Manor (Primary Monitor)	166 µg/m^3	12th
11/16/2018*	06-067-0006-2	Del Paso Manor (Audit Monitor)	163 µg/m^3	13th
10/27/2019 **	06-067-0010-4	Sacramento T Street	174 µg/m^3	11th

Notes:

* Concentrations are ranked from highest to lowest. Two sites had the same value on 11/16/2018 (163 µg/m^3) so they were both ranked as 13th.

** This exceedance will not be included in the Exceptional Event Analysis because it was not a result of CAMP.

Table 3-3 shows PM_{10} concentrations at monitoring stations in Sacramento County during the 7-day period from November 10 to 16, 2018. Concentrations that exceeded the PM_{10} standard of 150 µg/m^3 are highlighted in gray. Concentrations on November 13, 2018 at Sacramento T-Street and November 16, 2018 at Sacramento Branch Center were still extremely high but were just below the standard of 150 µg/m^3.

Table 3-3 Exceedance Dates at each of the Monitoring Stations

Date	Sacramento - T Street	Del Paso Manor (Site 1)	Del Paso Manor (Site 2)	North Highlands	Sacramento – Branch Center
Sampling Schedule	**Daily**	**1 in 6 days**	**1 in 6 days**	**1 in 6 days**	**1 in 6 days**
11/10/2018	189	202	212	222	200
11/11/2018	174				
11/12/2018	183				
11/13/2018	147				
11/14/2018	181				
11/15/2018	292				
11/16/2018	252	163	166	163	148

Note: Samples collected at Sacramento-Branch Center, Del Paso Manor (Site 1 and Site 2) and North Highlands are collected 1 in 6 days, so a single exceedance from one of these monitoring stations causes the average number of exceedance days over a three-year period to be 2.

3.3. Summary

The conceptual model describes the meteorological conditions that occurred during the CAMP. The fire quickly spread due to dry conditions from a lack of precipitation and gusty winds. Heavy gusts transported the smoke into communities downwind of the fire, including into Sacramento County. Smoke that accumulated during this period caused exceedances and eventual violations of the PM_{10} standard for Sacramento County. All the monitoring stations in the PM_{10} Maintenance Area exceeded the PM_{10} standard during CAMP during the period between November 10 to 12 and November 14 to 16, 2018.

4. Clear Causal Relationship

The Exceptional Event Rule requires that a clear causal relationship exists between the measured exceedances and the exceptional event to demonstrate that the exceptional event caused a specific air pollution concentration at a particular air quality monitoring location. The analysis provided in this section is consistent with the clear causal relationship examples provided in the Final Rule on the Treatment of Data Influenced by Exceptional Events (81 FR 68241, Tables 1 and 2)[7].

The clear causal relationship shows that CAMP caused the elevated PM_{10} concentrations in Sacramento County that exceeded the PM_{10} 24-hour NAAQS of 150 ug/m^3. An analysis was done showing how much higher these concentrations were when compared to historical data. Moderate Resolution Imaging Spectroradiometer (MODIS) satellite photos (NASA, 2020)[8], HYSPLIT trajectory modeling[9] (USEPA, 2020b), wind patterns, and PM_{10} concentrations were all used to show how smoke from CAMP was transported into Sacramento County to cause the exceedances on the six affected days. Smoke was even transported further southwest into the Bay Area where air quality advisories were also issued.

4.1. Comparison of Event Related Concentrations to Historical Concentrations

The Exceptional Event Rule requires a comparison of concentrations related to the event to historical data (81 FR 68216). PM_{10} concentrations measured during the month of the CAMP event, November 2018, were averaged and compared to historical data for the same month in 2015, 2016, 2017, and 2019 as shown in Table 4-1. Based on this analysis, the average PM_{10} concentration at each monitoring station for November 2018 was:

- Five (5) times higher than the average PM_{10} concentrations for the month of November in 2015, 2016 and 2017; and
- Two (2) times higher than the average PM_{10} concentration for the month of November in 2019.

On October 27, 2019, elevated PM_{10} readings, potentially caused by high wind dust as well as potential smoke, resulted in an exceedance that occurred at Sacramento T-Street. This single exceedance will have no regulatory impact, provided the exceedances in this exceptional event analysis are approved.

[7] Table 1 provides example analyses and guidance for most event types used to support the Clear Causal Relationship, and Table 2 describes the proposed analysis used for the comparison to historical concentrations.

[8] Modis satellite photos are taken daily from the Aqua and Terra satellites.

[9] The HYSPLIT is a model for computing simple air parcel trajectories, as well as complex transport, dispersion, chemical transformation, and deposition simulations.

Table 4-1 Average PM_{10} Concentrations ($\mu g/m^3$) during November

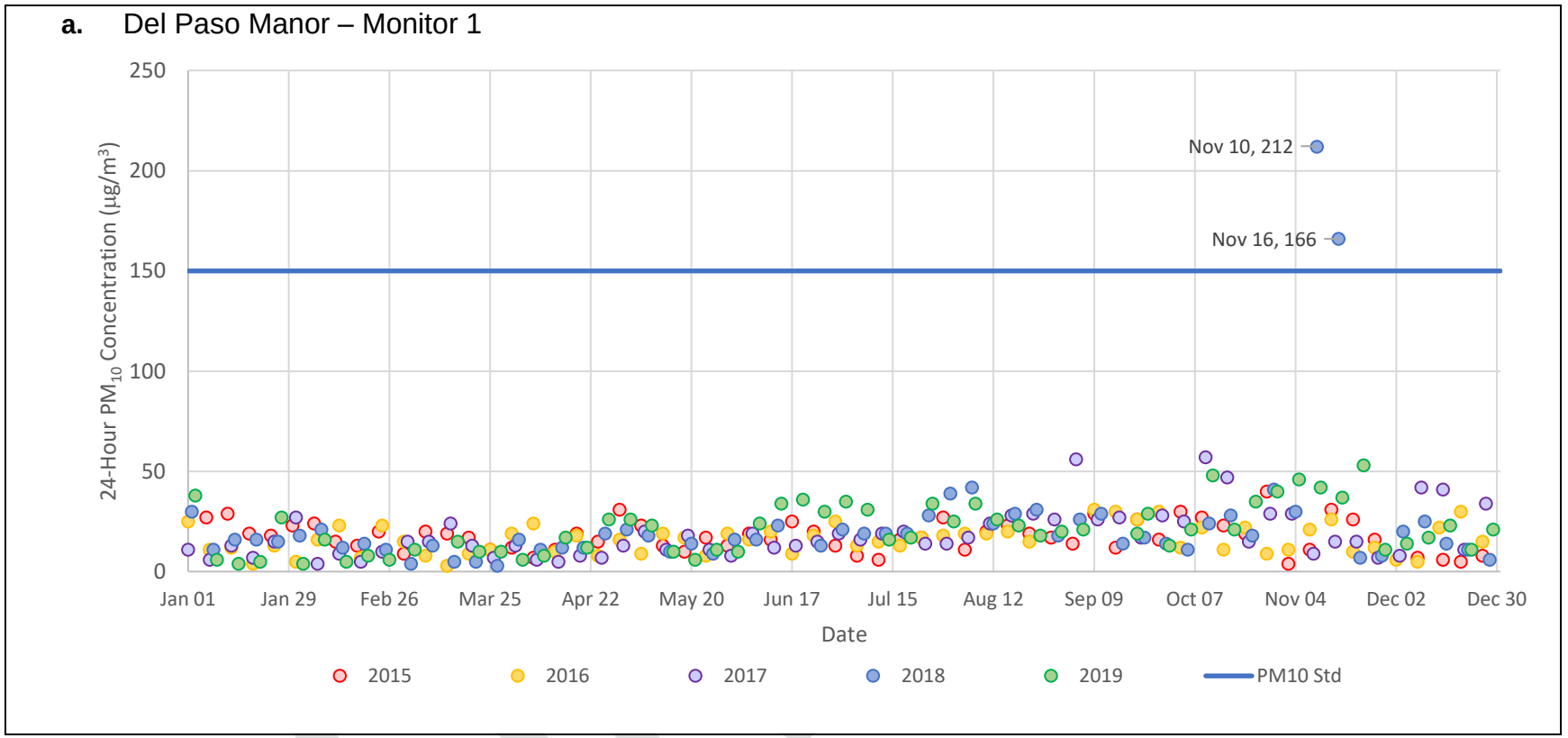
Year	North Highlands	Del Paso Manor-1*	Del Paso Manor-2*	Sac T Street	Branch Ctr
2015	12.8	17.6	17.6	18.5	14.2
2016	12.6	16.0	15.2	20.4	14.8
2017	14.4	15.0	15.0	21.5	17.6
2018	85.6	84.6	82.0	85.0	78.4
2019	36.6	37.8	38.4	41.9	36.6

* Del Paso Manor monitoring station has two PM_{10} monitors, a primary monitor (Del Paso Manor 1) and audit monitor (Del Paso Manor 2).

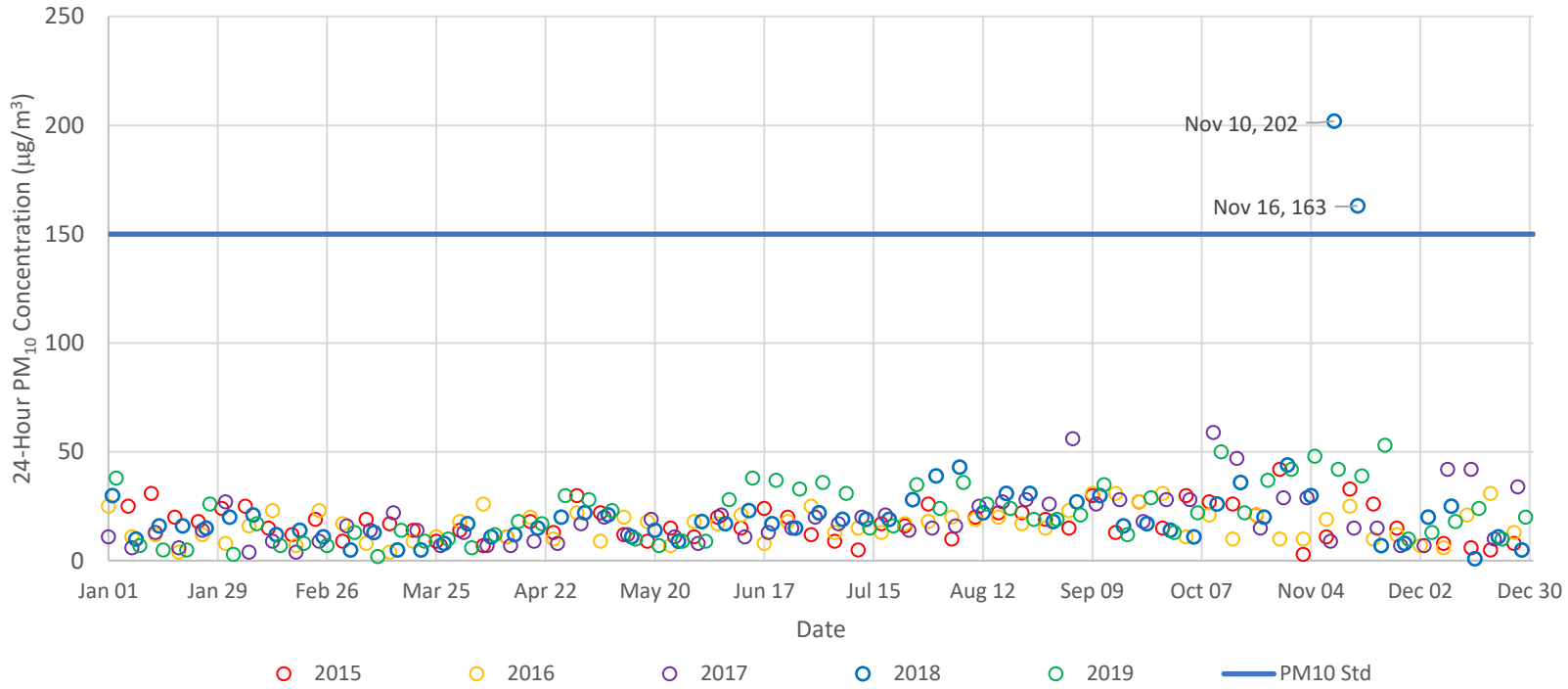
Figures 4-1(a-e) show 24-hour PM_{10} concentrations at the four monitoring stations from 2015 through 2019. In this period, 14 exceedances have occurred: 13 exceedances in 2018 and one (1) exceedance in 2019. These figures are consistent with previous tables, which also show that these were the highest 14 PM_{10} concentrations in Sacramento County. All the concentrations that exceeded the PM_{10} standard of 150 $\mu g/m^3$ are labeled with the dates and corresponding concentrations (in $\mu g/m^3$).

The exceedance of 174 $\mu g/m^3$ that occurred on October 27, 2019 at the Sacramento T-Street monitoring station was not included as part of this request. If this exceedance is determined to have regulatory significance in the future, then a separate request will be submitted to EPA.

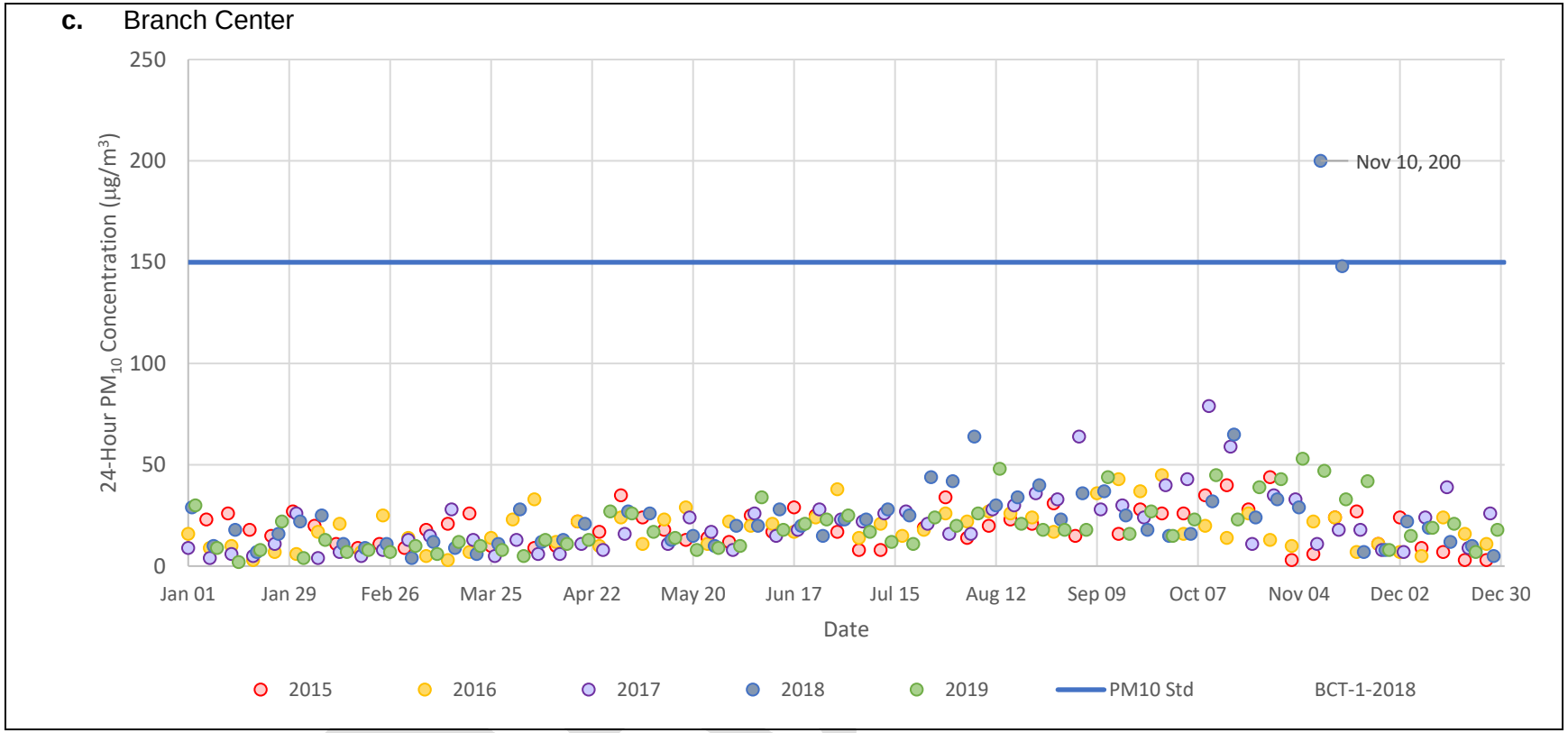
Figures 4-1(a-e) 24-hour PM_{10} concentrations for monitors in Sacramento County from 2015-2019



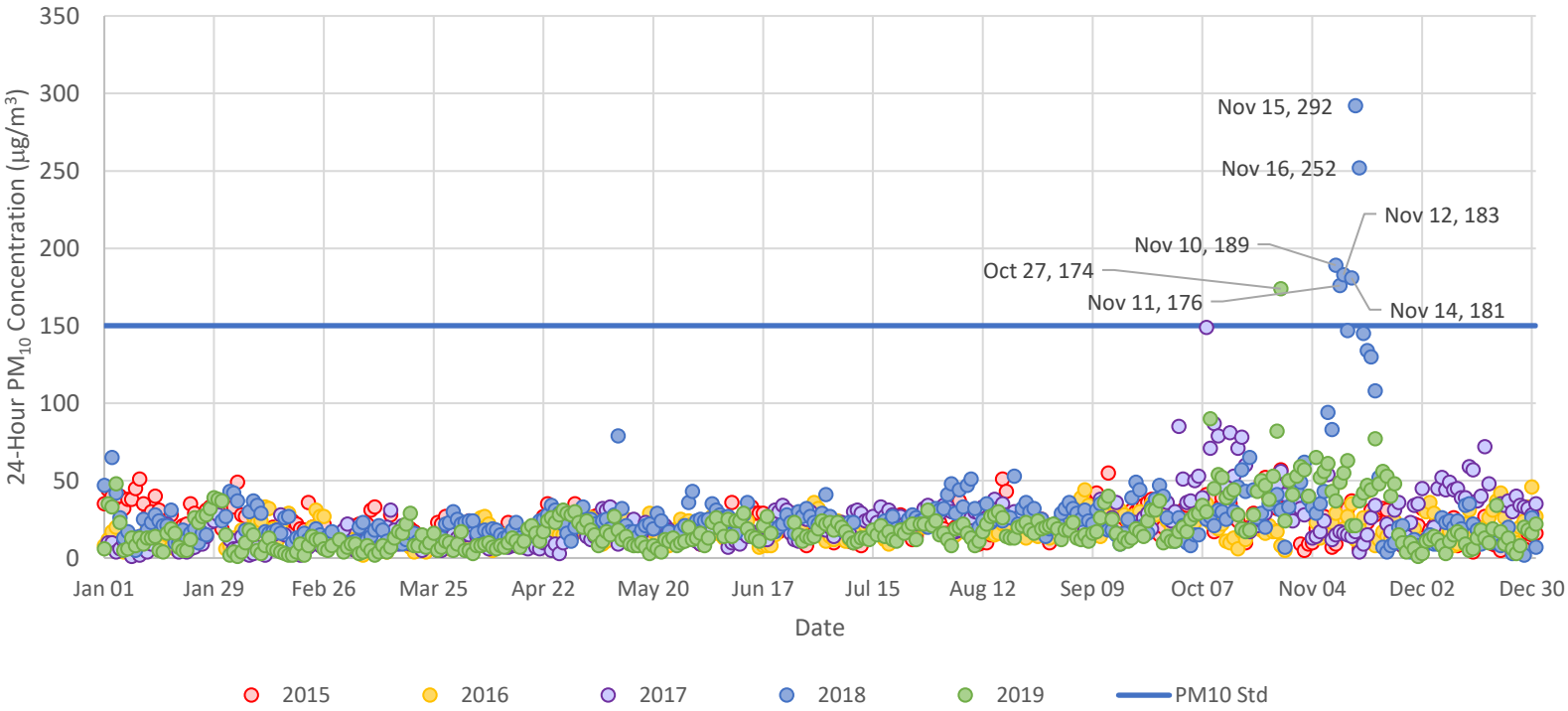
b. Del Paso Manor (Co-located monitor)



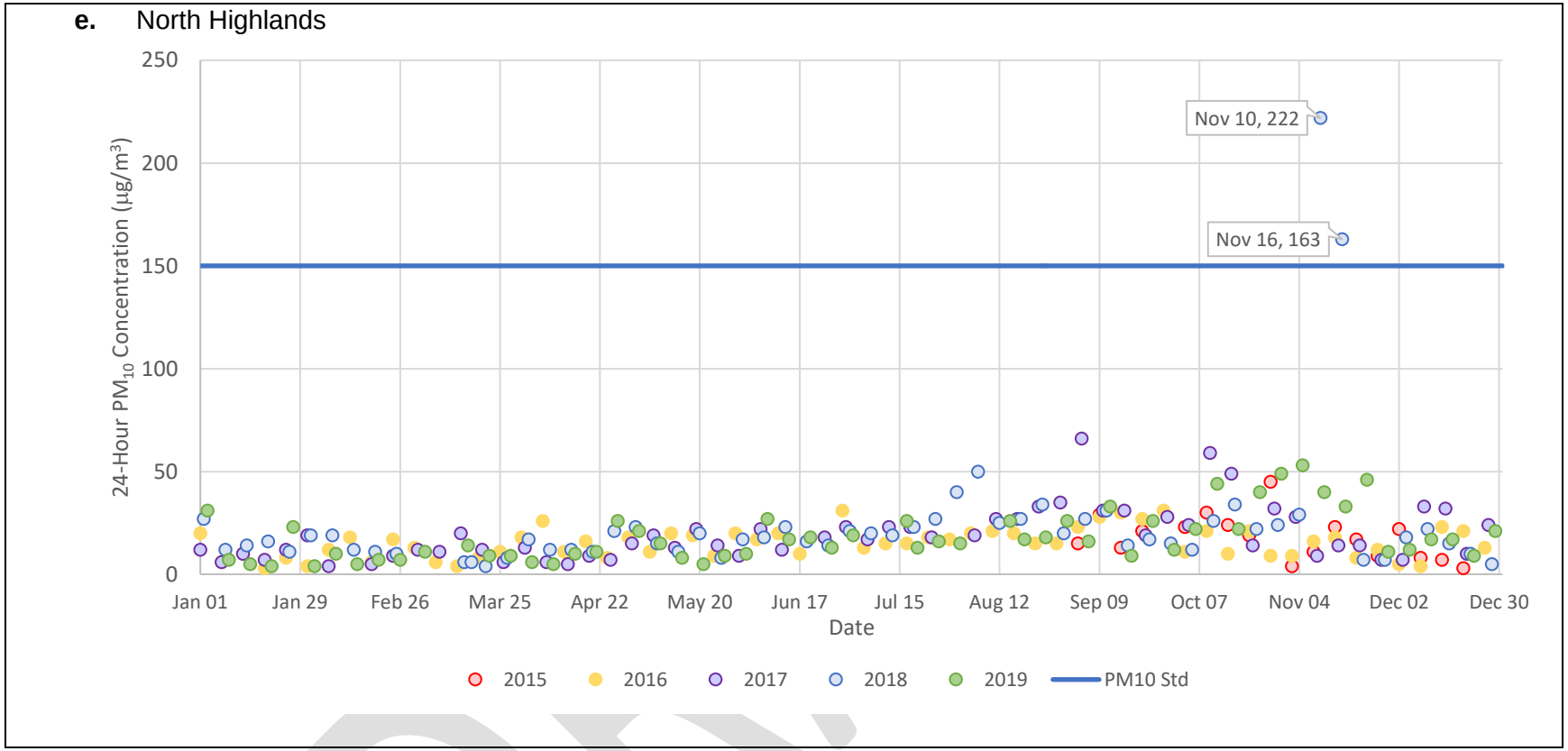
c. Branch Center



d. Sacramento T Street



e. North Highlands



4.2. Geographic Extent of the Wildfire Smoke Impact

This section describes the extent of the smoke impact from the CAMP and discusses the air quality advisories that were issued during the fire. Although this analysis focuses on the exceedances of the PM_{10} standard at the monitors within Sacramento County, there were exceedances of the standard outside of the county, which showed the extent of impact associated with the smoke plume generated by the CAMP.

Table 4-2 and Appendix B show the daily geographic extent of smoke impacts on PM_{10} concentrations on November 7 through November 25, 2018, from the north, south, east and west of Sacramento. Table 4-2 also shows that on November 7, 2018, the day before the CAMP started, the PM_{10} concentrations were below 50 µg/m^3 in Sacramento and the surrounding communities. Once the fire ignited on November 8, 2018, and the smoke was transported into the region, PM_{10} concentrations started to elevate in Sacramento County and throughout the region. On November 10, 2018, concentrations in Sacramento County and nearby surrounding counties exceeded the PM_{10} standard. After the last exceedance was recorded in Sacramento County on November 16, 2018, PM_{10} concentrations gradually started to go down until November 21, 2018, when they were back down to either below or just above 50 µg/m^3 in Sacramento and nearby surrounding counties.

The Chico PM_{10} monitoring station, which is the closest PM_{10} monitor to the fire, recorded concentrations that were below 50 µg/m^3 the day the fire ignited on November 8, 2018, which then jumped to above 150 µg/m^3 one day later (November 9, 2018) where it remained through November 18, 2018, every day except on November 11, 2018. The sources and transport of emissions are discussed further in Section 4.3.

Figure 4-2 Geographic Extent of Monitoring Stations Surrounding Sacramento County

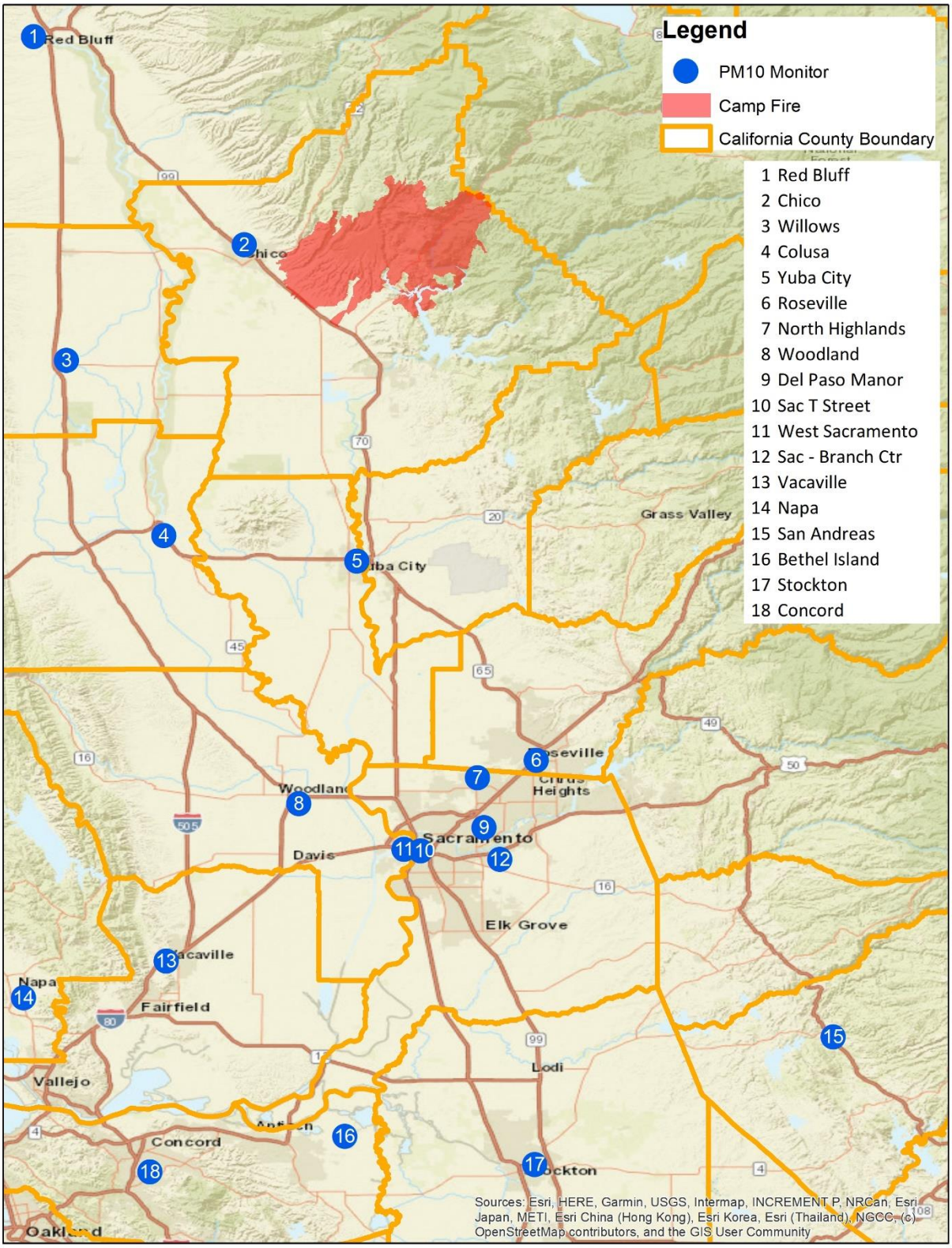


Table 4-2 Geographic Extent Impacts from CAMP

Date	Sacramento/ Location Area (Fig 4-2, Monitor 10)	PM_{10} 24-hour Concentrations at Monitoring Stations Relative to Sacramento ($\mu g/m^3$)			
		North/Location Area (Fig 4-2, Monitor 2)	South/Location Area (Fig 4-2, Monitor 17)	South East/Location Area (Fig 4-2, Monitor 6)	West/Location Area (Fig 4-2, Monitor 8)
11/7/2018	T-Street: 44	Chico: 26	No Data	Roseville: 30	No Data
11/8/2018	T-Street: 95	Chico: 42	No Data	Roseville: 80	No Data
11/9/2018	T-Street: 83	Chico: 329	No Data	Roseville: 49	No Data
11/10/2018	T-Street: 190	Chico: 275	Stockton: 187	Roseville: 202	Woodland: 139
11/11/2018	T-Street: 176	Chico: 60	No Data	Roseville: 121	No Data
11/12/2018	T-Street: 183	Chico: 164	No Data	Roseville: 65	No Data
11/13/2018	T-Street: 147	Chico: 166	No Data	Roseville: 96	No Data
11/14/2018	T-Street: 181	Chico: 234	No Data	Roseville: 146	No Data
11/15/2018	T-Street: 292	Chico: 339	No Data	Roseville: 171	No Data
11/16/2018	T-Street: 252	Chico: 454	Stockton: 173	Roseville: 80	Woodland: 201
11/17/2018	T-Street: 146	Chico: 216	No Data	Roseville: 118	No Data
11/18/2018	T-Street: 134	Chico: 166	No Data	Roseville: 64	No Data
11/19/2018	T-Street: 131	Chico: 95	No Data	Roseville: 64	No Data
11/20/2018	T-Street: 109	Chico: 134	No Data	Roseville: 42	No Data
11/21/2018	T-Street: 53	Chico: 52	No Data	Roseville: 27	No Data
11/22/2018	T-Street: 8	Chico: 10	Stockton: 12	Roseville: 8	Woodland: 6
11/23/2018	T-Street: 5	Chico: 6	No Data	Roseville: 4	No Data
11/24/2018	T-Street: 9	Chico: 12	No Data	Roseville: 9	No Data
11/25/2018	T-Street: 11	Chico: 17	No Data	Roseville: 12	No Data

Concentrations Shading (this shading does not correspond to Air Quality Index values)

- 0 to 50 $\mu g/m^3$
- 51 to 100 $\mu g/m^3$
- 101 to 150 $\mu g/m^3$
- >151 $\mu g/m^3$

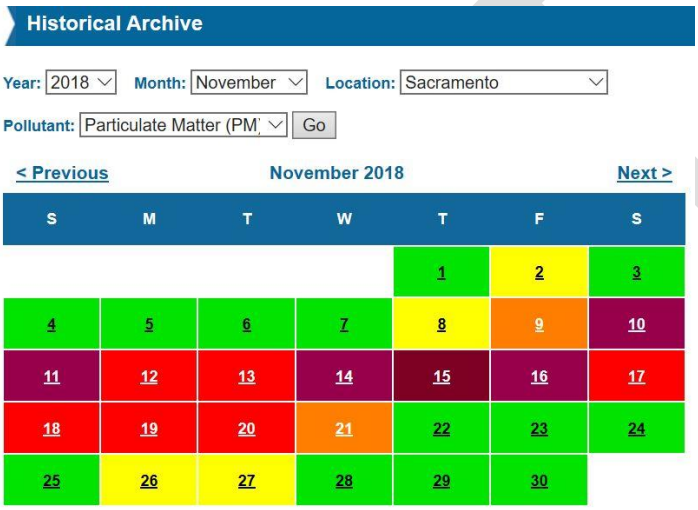
Air Quality Health Advisories and Air Alert Notifications

The Sac Metro Air District sent out Air Alert Notifications (Spare the Air Alerts) that reflected the elevated Particulate Matter ($PM_{2.5}$ and PM_{10}) levels. These alerts were issued in Sacramento County for every exceedance day and coincide with the Air Quality Index (AQI) Maps shown in Appendix C. Appendix C shows figures of the daily Particulate Matter AQI values from November 7 (a day before CAMP) to November 25, 2018 (the day the fire was contained) for Sacramento and the surrounding areas.

Figure 4-3 shows a summary of the AQI levels in Sacramento for November 2018, which had extremely elevated AQI levels from November 10 through November 16, 2018. These days included the days when the PM_{10} concentrations exceeded (November 10 -12 and November 14 – 16, 2018) the PM_{10} standard in Sacramento County.

In addition to the Air Alert Notifications, the Sac Metro Air District in coordination with Sacramento County Public Health Office issued wildfire smoke advisories during the CAMP. On November 9, 2018, an advisory was issued, which advised Sacramento County residents to take precautions, stay indoors with doors and windows closed, and minimize outdoor activities. See Appendix D for copies of the advisories.

Figure 4-3 Particulate Matter Air Quality Index Summary for Sacramento



Source: Sacramento Metropolitan Air Quality District "Air Quality Information for the Sacramento Region. Historical Archives" Web. 16 October 2020 < http://www.spareheair.com/histcalendar.cfm?selYear=2018&selMonth=11&selLocation=SAC&selParam=pm25 >

AQI maps in Appendix C also show the smoke-impacted areas, including areas adjacent to the Sacramento PM_{10} Maintenance Area. The levels in Sacramento and surrounding area were classified as either "Unhealthy," "Very Unhealthy," or "Hazardous". The AQI maps reflect that air quality improved to an AQI of "Moderate" or "Good" as the smoke from the fire dissipated and the fire neared 100% containment. These AQI maps coincide with the satellite imagery, which showed the smoke plume caused by the fire.

Air quality alerts were also issued outside of Sacramento County as far south to Stockton where PM_{10} concentrations also exceeded the standard. The smoke from the fire resulted in widespread air pollution throughout the Sacramento Valley, the San Francisco Bay Area, and Central Valley, prompting the closure of public schools. In addition to the K-12 school closures in the Sacramento, community colleges and universities like UC Davis and California State University, Sacramento closed as well (McGough, 2018).

4.3. Sources and Transport of Emissions

Moderate Resolution Imaging Spectroradiometer (MODIS) developed by the National Aeronautics and Space Administration (NASA) was used to display the images of the wildfire. MODIS has 36 discrete spectral bands, and these sensors are very sensitive to detection of fires. MODIS

is an extensive program using sensors on two satellites that each provide complete daily coverage of the earth. The data have a variety of resolutions; spectral, spatial and temporal. The MODIS sensor is carried on both the Terra satellite, which provides morning images and the Aqua satellite, which provides afternoon images. The combination of the Aqua/Terra satellite imagery provides true color images of what the smoke plume was like for each of the six exceedance dates.

Satellite imagery is shown on Figures 4-4(a-g); the gray color shows the location of the smoke plume and the red triangles indicate the locations of the wildfire. The satellite images for each of these figures show the smoke plume was generated by CAMP and encompasses the four PM_{10} monitors in Sacramento County where exceedances of the PM_{10} standard were recorded. The smoke is present for multiple days, which resulted in the monitors showing PM_{10} concentrations above the standard. During each of these days, the CAMP created a massive smoke plume, which moved south and southeast and transported smoke at multiple heights. Hot spots, or the locations of the wildfire, are shown as red triangles, and the background layer is shown as Aqua/Terra satellite imagery with wind barbs identified by the black lines with the circles. All information is available from the National Oceanic and Atmospheric Administration (NOAA).

Satellite images were used in conjunction with the Hybrid Single Particle Lagrangian Integrated Trajectory Model (HYSPLIT)[10]. To determine the sources and transport of emissions, the HYSPLIT trajectory model was used to determine the pathway of the smoke to the monitoring stations (referred to as backward trajectories). The HYSPLIT trajectory model calculates the position of particles with time and considers the trajectory of the air parcel using wind speed and direction.

The HYSPLIT trajectory model was run on EPA AirNow-Tech, Navigator with the satellite imagery in the background. By having the satellite imagery in the background, the smoke plume caused by CAMP is clearly shown. There were three input layers used in this model, at 50 meters (m) above the surface (green), 500 meters (blue) and 1000 meters (red).

Backward Trajectories

To determine the transport of smoke to the monitors, 24-Hour HYSPLIT backward trajectories were conducted. Figures 4-4(a–g) correspond to event dates November 10 through November 16[11], and include 24-hour backward HYSPLIT trajectories from the Sacramento T-Street monitoring station and elevation profile for each exceedance date (Figures 4a – 4c and 4e – 4g). These figures show that smoke to the Sacramento T-Street monitoring station and surrounding monitoring stations originated from the smoke plume generated by CAMP. These backward trajectories showed the movement of smoke over a 24-hour period towards the monitoring stations. The backward trajectories were initiated at three altitudes: 50 meters (green), 500 meters (blue) and 1000 meters (red). These were the starting heights (from the T Street monitoring station), for the backward trajectory and these heights changed over the 24-hour trajectory as shown in the elevation profiles.

[10] Hysplit is a computer model that is used to compute air parcel trajectories and deposition or dispersion of atmospheric pollutants. It was developed by NOAA (2019) and Australia's Bureau of Meteorology.

[11] On 11/13/18, there was a high cloud cover and there was not an exceedance, but this date is included to show the reason why there was not an exceptional event for that date.

Each of the three trajectory lines had five dots with the dot furthest away from the monitoring location representing the start of the 24-hour period and the dot at the monitor station representing the end of the of the 24-hour period. The trajectories started at 2 am on the date shown on the satellite image from T Street and the furthest dot was at 2 am on the previous day. The date and time for the three dots between these two corresponded to the 6-hour interval of time between them (8 pm, 2 pm, and 8 am on the day preceding the date shown on the lower left corner of the satellite figure).

These three height levels provided an indication of how the smoke was transported in the lower portion of the atmosphere. The initiating heights were chosen to provide insight into relevant vertical levels, which could impact surface air quality in Sacramento. An important measurement was the boundary layer height, which was crucial in determining ground-level smoke impacts. It was often characterized by a stable layer, which can trap pollutants such as smoke near the surface.

The boundary layer height was estimated using a ceilometer, which measures attenuated backscatter of light due to gradients in particulate matter or other aerosols, such as those found at the interface between the boundary layer and the free troposphere. From ceilometer data collected approximately 30 kilometers away (example of November 15, 2018 in Figure 4-5), the boundary layer height (white line) was roughly estimated to reach at least 500 meters throughout the period. The colors in this figure represent the backscatter intensity as measured by the ceilometer, where the intensity correlates with particulate matter concentrations. Note that in Figure 4-5, the ceilometer software estimated multiple boundary layer heights as can be seen by the multiple white lines. The software was developed using typical atmospheric conditions (not heavily smoke impacted) and looking for sharp gradients in backscatter intensity, which is generally a clear indication of the boundary layer height. However, due to the heavy smoke and increased particulate matter loading, the software identified the smoke layers (sharp gradients in backscatter intensity) as boundary layer height estimations. Since the lowest portion of the atmosphere was primarily where we were concerned, the initiated heights selected for the trajectories provided confirmation of smoke transport within and just above the boundary layer.

The direction of each trajectory provided information on the speed and direction of wind within this lower portion of the atmosphere. In general, wind speed increases with height as friction decreases, and it is common that due to synoptic-scale meteorology, direction will change as well. For example, in Figure 4-4c, the trajectories initiated at 500 and 1000 meters did not travel directly over the fire location; however, the 50 meters trajectory and the accompanying imagery clearly showed that smoke within the lowest portion of the atmosphere (i.e. the boundary layer) was trapped within the local terrain and was transported directly to Sacramento. This was confirmed by the much higher than normal intensity of the return signal in the ceilometer data within the boundary layer in Figure 4-5.

Even if the 500- and 1000-meter trajectories were not within the boundary layer, they provided valuable information whether elevated smoke plumes were possible over Sacramento. It was possible that an elevated plume could mix to the surface from thermal expansion of the boundary layer during the daytime hours or could lower to the surface at night as a nocturnal stable layer form.

The 50-meter trajectories (shown in green) for Figures 4-4 (a-g) indicated that the smoke trapped within the lowest portion of the atmosphere was consistently being transported to the monitors from the north to the northeast. The elevation profiles for the 50-meter trajectories showed that the elevation did not change much and was consistently about 50 meters. The 1000-meter trajectories showed that the elevation changed much more. For example, on November 11, 2018

(Figure 4-4b), the trajectory started at 3861 meters and went down to 1000 meters at T-Street, and on November 12, 2018 (Figure 4-4c), the trajectory started at 3760 meters before going down to 1000 meters at T-Street. On November 12, 2018, the 500-meter trajectory started at 3534 meters. When the trajectory started at the higher elevation, the smoke appeared to be above the boundary layer. The elevation profiles of the back trajectories suggested that smoke was consistently driven from the fire at elevations below about 700 meters. The satellite images showed this plume was generated by CAMP, and the backward trajectory analysis clearly showed that wildfire emissions from this plume reached the T Street monitoring station.

Figure 4-4d shows that on November 13, 2018, smoke was present in the Sacramento region with elevated concentrations (147 µg/m^3) above historical normal but the concentrations did not go above the PM_{10} standard. Based on measured particulate matter concentrations and smoke plumes, heavy smoke was clearly present at stations north and west of Sacramento throughout the day. Ceilometer data and available upper air soundings suggested that smoke was elevated between 100-500 meters in the morning hours in the region and due to inversion conditions, the plume remained stationary vertically. By the afternoon, vertical mixing and slight northerly winds transported thick smoke to the surface in Sacramento increasing concentrations, but the 24-hour concentration for the day fell just below the 150 µg/m^3 standard.

Figures 4-4 (e-g) show that smoke continued to be thick, which caused concentrations to drive up the 24-hr average and exceeded the standard. Air quality concentrations after November 16, as shown in Table 4-2, in Sacramento County and beyond were not elevated enough or prolonged enough to exceed the standard.

Figure 4-4 HYSPLIT Backward Trajectories for the Camp Wildfires 2018

Figure 4-4a (November 10, 2018)

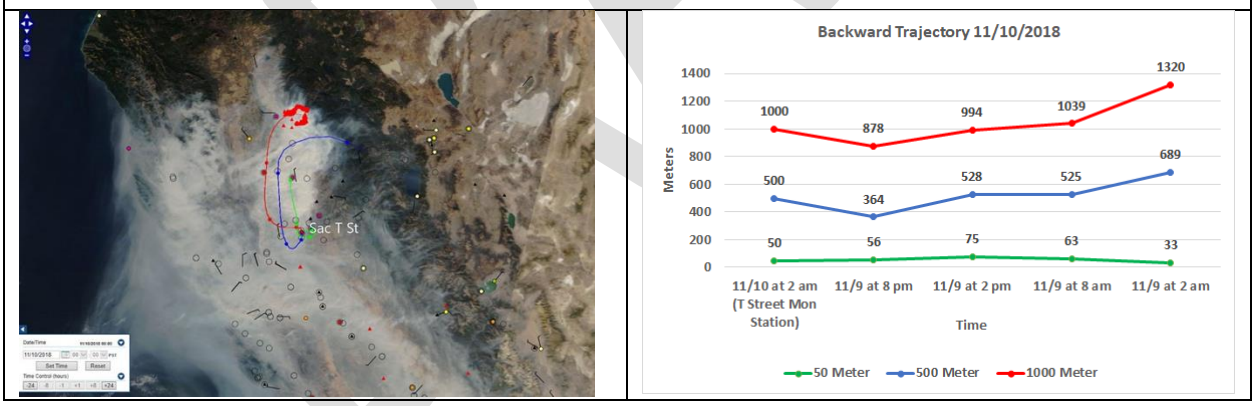
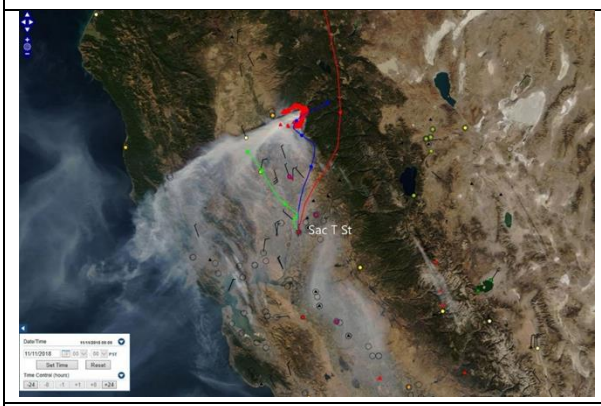


Figure 4-4b (November 11, 2018)



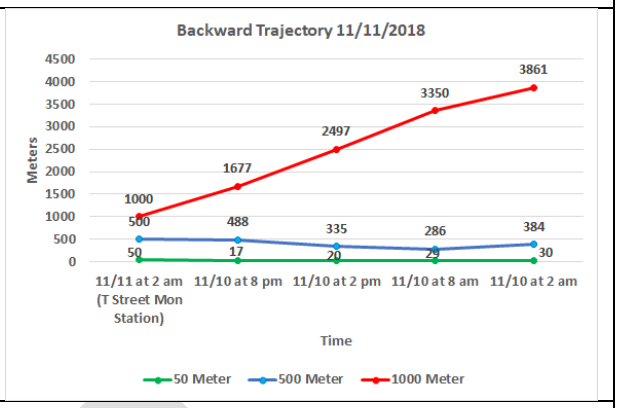


Figure 4-4c (November 12, 2018)

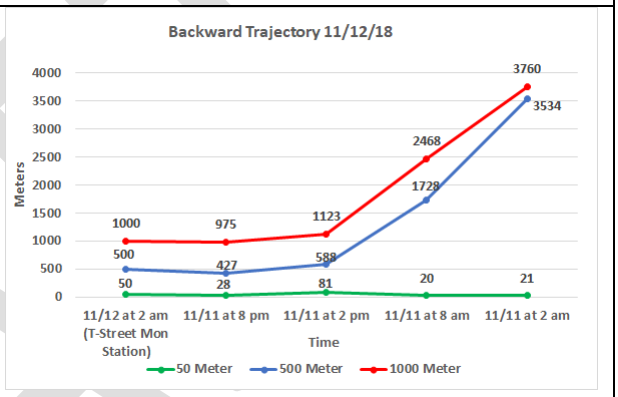
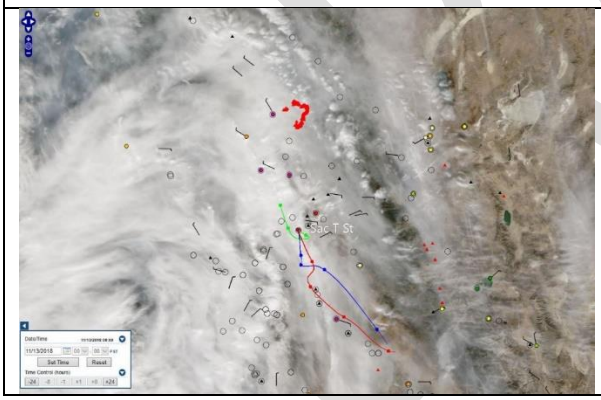
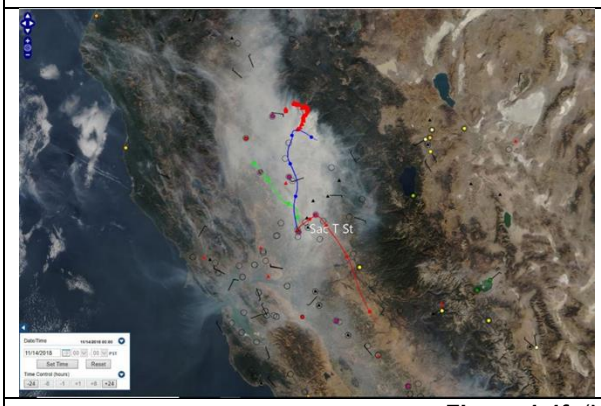


Figure 4-4d (November 13, 2018)



November 13, 2018 is not an exceedence PM_{10} day.

Figure 4-4e (November 14, 2018)



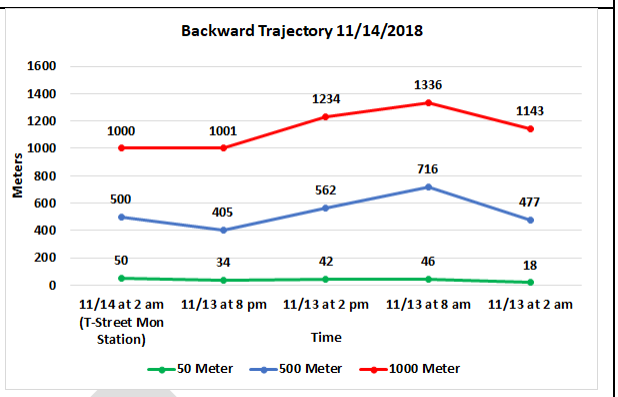
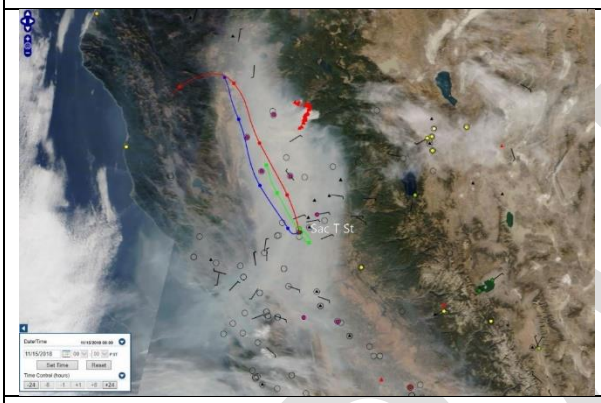


Figure 4-4f (November 15, 2018)



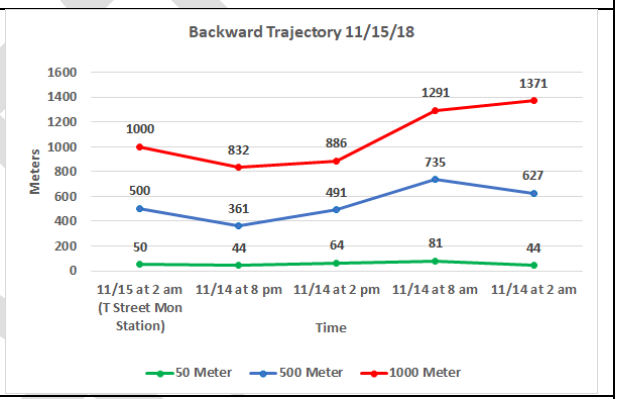
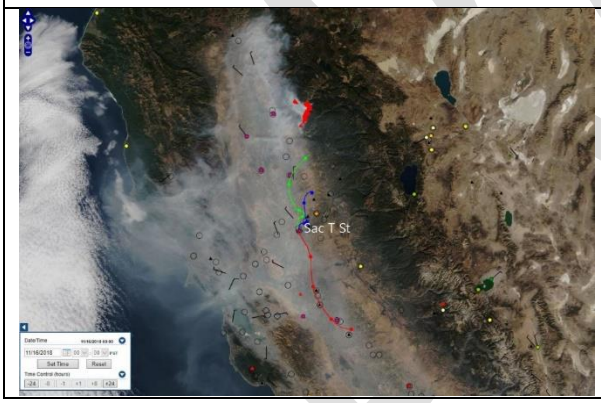


Figure 4-4g (November 16, 2018)



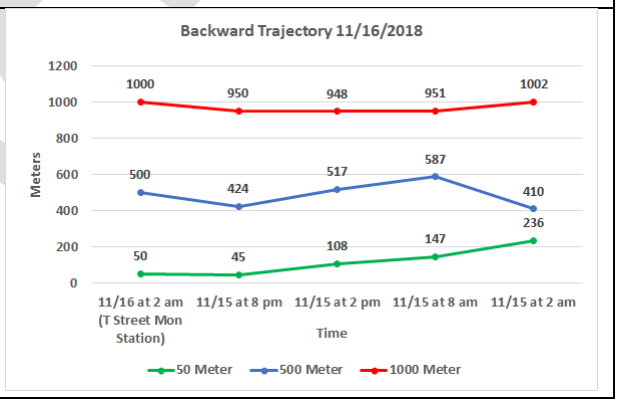
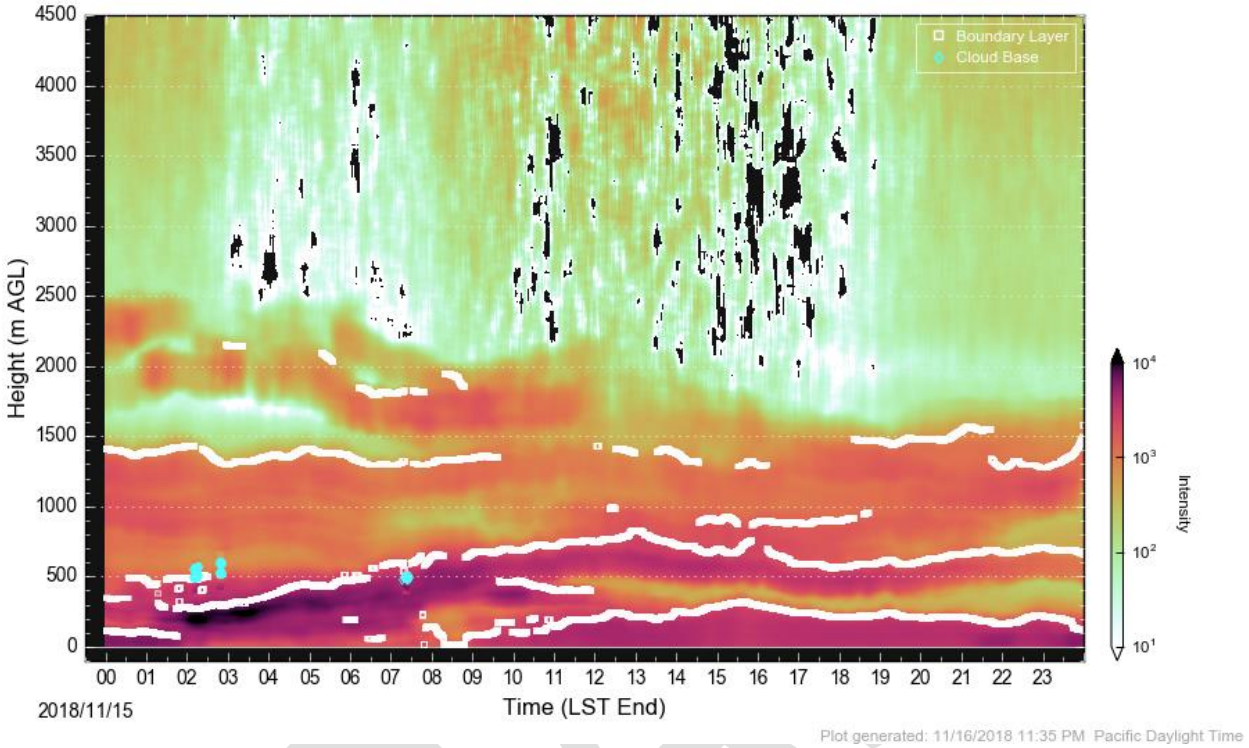


Figure 4-5 Ceilometer data collected for 11/15/2018



Note this is raw data. The ceilometer is located at the Elk Grove-Bruceville air monitoring station which is located south of Del Paso Manhyteryeeor. For more information see: http://www.airquality.org/Air-Quality-Health/Air-Monitoring.

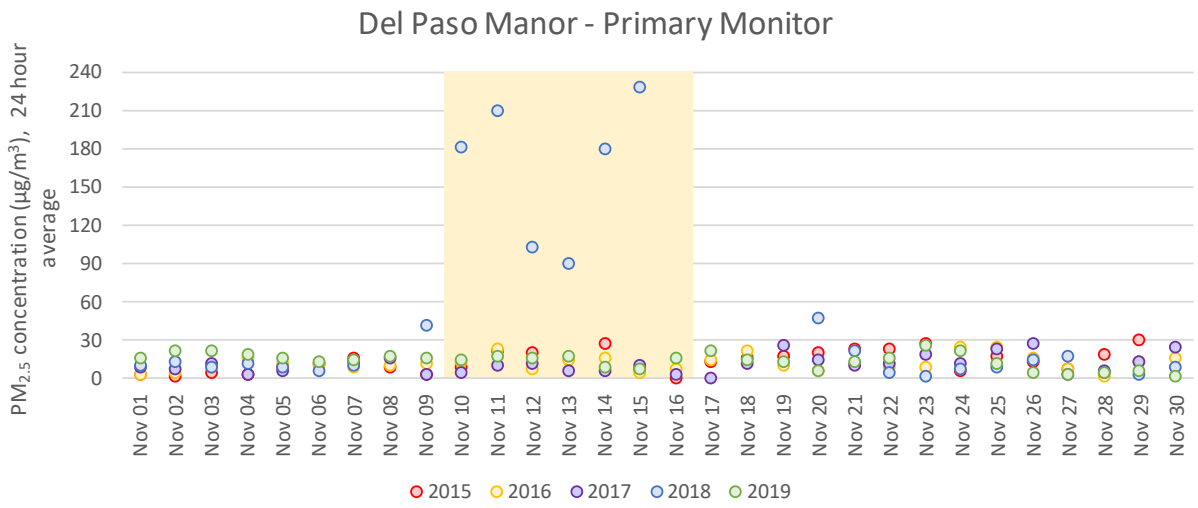
4.4. Chemical Composition and Size Distributions

Smoke from wildfire is composed of many compounds, including carbon dioxide**,** water vapor**,** carbon monoxide**,** particulate matters**,** hydrocarbons and other organic chemicals, and nitrogen oxides. The actual composition of smoke depends on the fuel type, the temperature of the fire, and the wind conditions (USEPA, 2001).

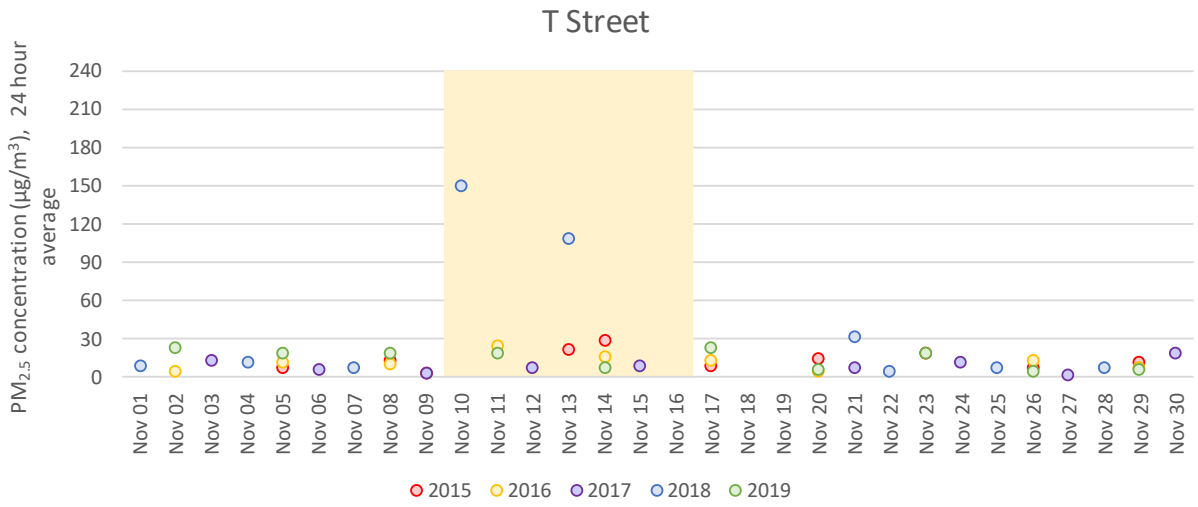
During wildfire events, smoke will increase the $PM_{2.5}$ concentrations along with PM_{10} concentration (Battye & Battye, 2002). The $PM_{2.5}$ concentrations at both the Del Paso Manor (Figure 4-6a) and T-Street (Figure 4-6b and 4-6c) monitoring sites during CAMP are above the 24-hour average $PM_{2.5}$ standard of 35 µg/m^3. In addition, the $PM_{2.5}$ concentrations recorded during November 2018 (shown in blue) during the CAMP were significantly higher than the concentrations recorded during November 2015, 2016, 2017, and 2019. The days in the area highlighted in brown are the exceedance days that occurred during CAMP.

Figure 4-4(a-c) $PM_{2.5}$ concentrations during November 2015 – 2019

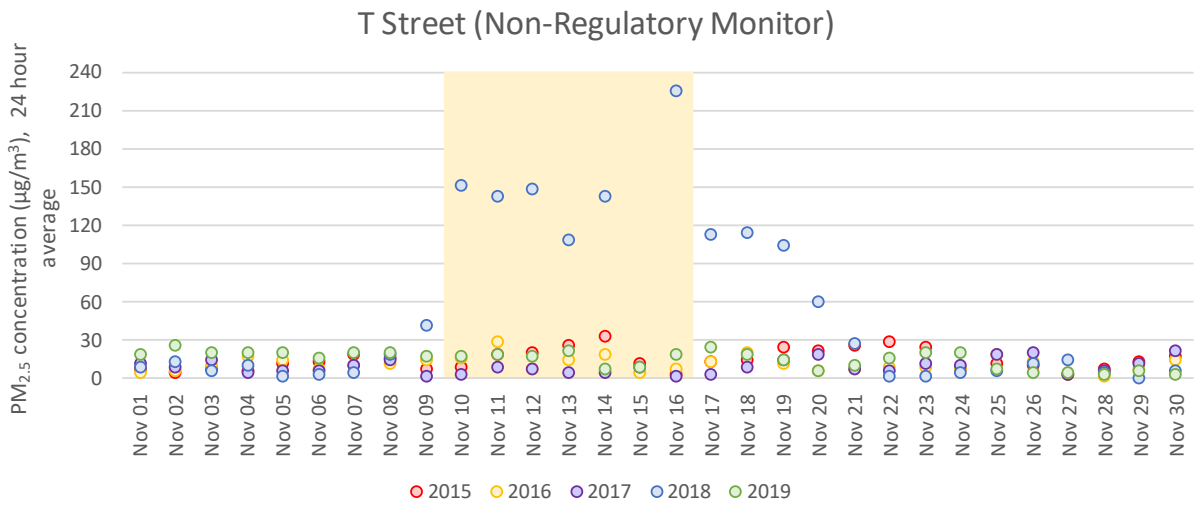
a. $PM_{2.5}$ concentrations during November 2015 – 2019 at Del Paso Manor



b. $PM_{2.5}$ concentrations during November 2015 – 2019 at T Street (Regulatory Monitor)



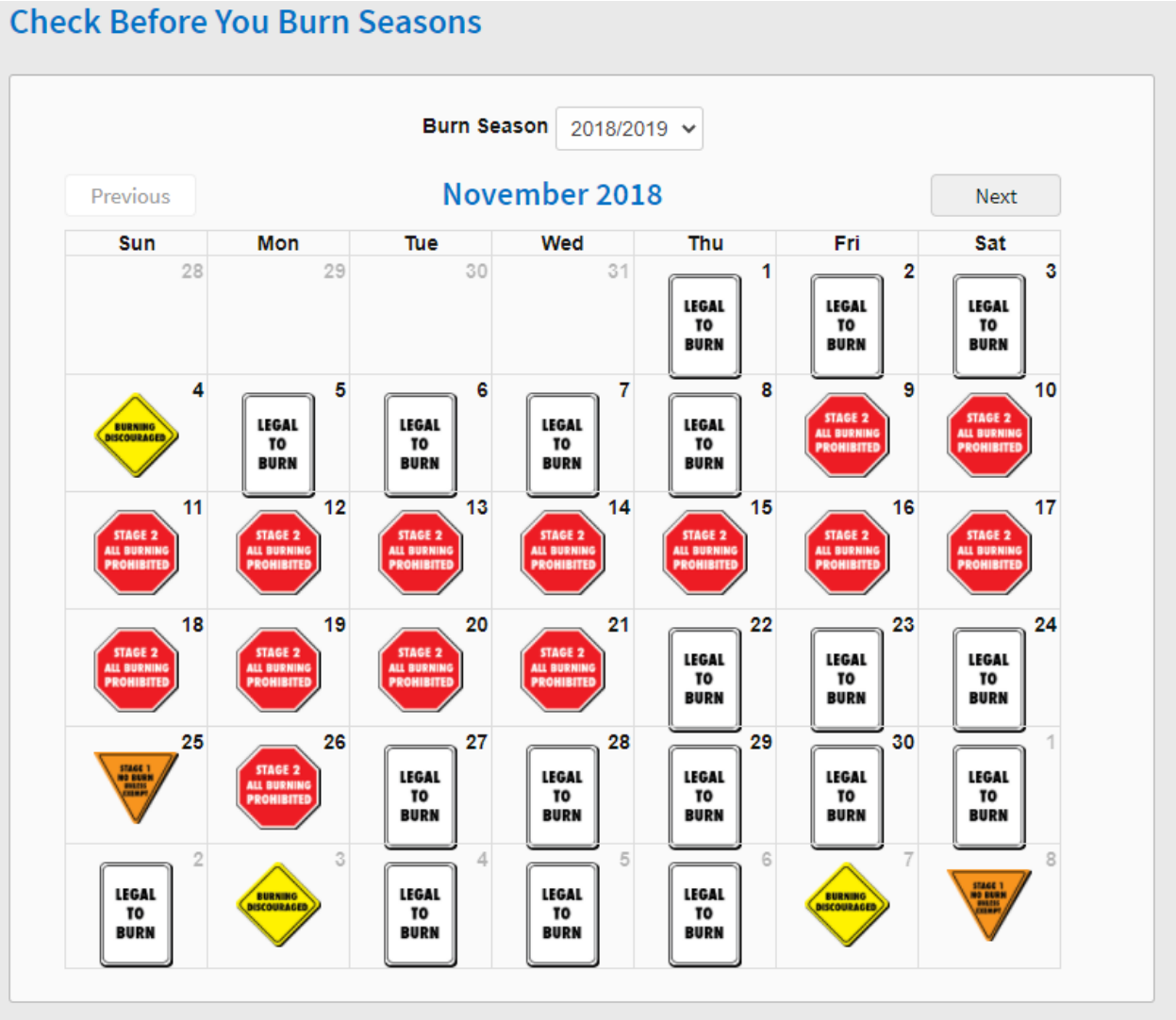
c. $PM_{2.5}$ concentrations during November 2015 – 2019 at T Street (Non-Regulatory Monitor)



Note: Nonregulatory data was analyzed at T-Street from 2015 through 2019 from November 10 – 16 to determine $PM_{2.5}$ trends during CAMP. Normal, regulatory sampling is conducted 1 in 3 days for $PM_{2.5}$.

The high $PM_{2.5}$ concentrations recorded are not suspected to be significantly attributed to emissions from residential wood combustion, which is typically observed during the winter months (November through February) in Sacramento. During the CAMP, all residential wood burning activities were not allowed as specified by District Rule 421, Mandatory Episodic Curtailment of Wood and Other Solid Fuel Burning. Rule 421 requires the District to declare a Stage 2 mandatory curtailment of all residential wood burning activities when the 24-hour average $PM_{2.5}$ concentrations are forecasted to exceed 35 µg/m^3. This rule is implemented through the District's Check Before You Burn Program and enforced by the District's inspection team. Figure 4-7 shows the Check Before You Burn declaration for each day in November 2018. On November 9 to November 21, 2018, within the time frame of the CAMP event, the District declared these days as "Stage 2 All Burning Prohibited" days. Therefore, it is suspected the main source of $PM_{2.5}$ emissions were from the CAMP smoke.

Figure 4-5 Check Before You Burn Forecast (Sac Metro Air District, 2020b)



For $PM_{2.5}$ data impacted by the CAMP, the air districts in the Sacramento Federal $PM_{2.5}$ Nonattainment Area and CARB submitted a separate Exceptional Event Initial Notification Summary for $PM_{2.5}$. EPA notified CARB and the air districts that the request to exclude $PM_{2.5}$ data influenced by the CAMP was noted, but it will be on hold until it has regulatory significance (USEPA, 2019).

4.5. Assessment of Auxiliary Air Quality Data

Emissions from wildfires include carbon monoxide (CO) and black carbon (BC), pollutants that were monitored for in Sacramento County. Of the four air monitoring sites that monitor for PM_{10}, one site, Sacramento-Del Paso Manor, monitors for CO and BC and one site, North Highland-Blackfoot Way, monitors for CO. Table 4-3 shows both the Criteria and Non-Criteria Pollutants that were measured at the Monitoring Stations in Sacramento County (Sac Metro Air District, 2020a).

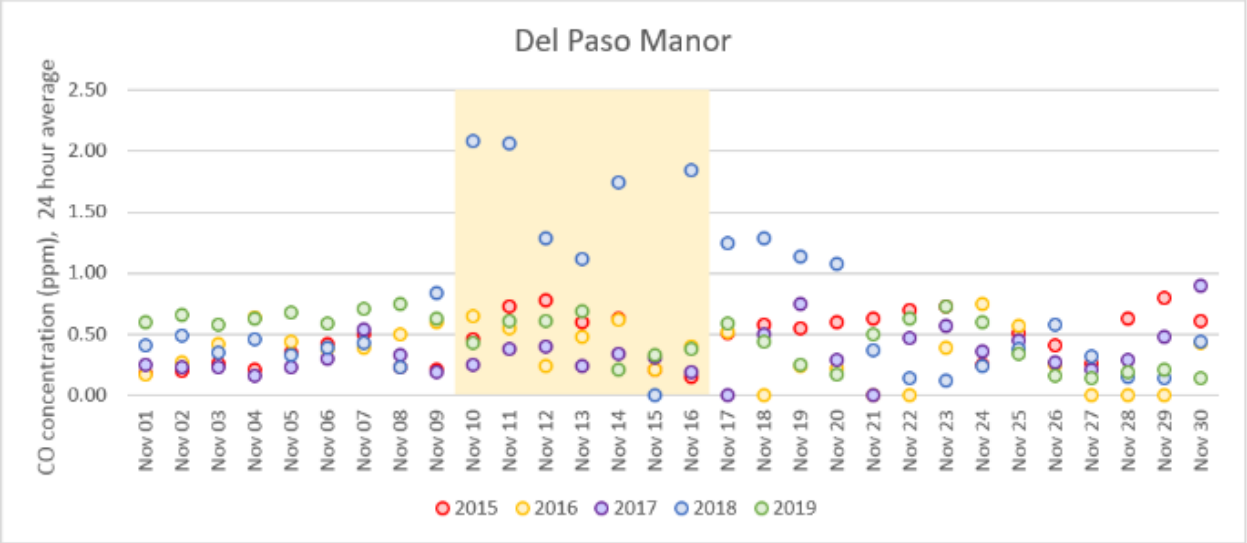
Table 4-3 Criteria and Non-Criteria Pollutants Measured at Monitoring Stations in Sacramento County

Station Name	O_3	CO	Black Carbon (BC)	NO_2	SO_2	$PM_{2.5}$ (Speciation)	PM_{10} (FEM)	PM_{10} (FRM)	$PM_{2.5}$ (FEM)	$PM_{2.5}$ (FRM)
Sacramento-Bercut Drive		✓								✓
Sacramento-Branch Center #2								✓		
Sacramento-Del Paso Manor	✓	✓	✓	✓	✓	✓		✓	✓	✓
Folsom-Natoma Street	✓			✓					✓	
North Highlands-Blackfoot Way	✓	✓						✓		
Sloughhouse	✓								✓	
Sacramento-T Street	✓			✓		✓	✓		✓	✓

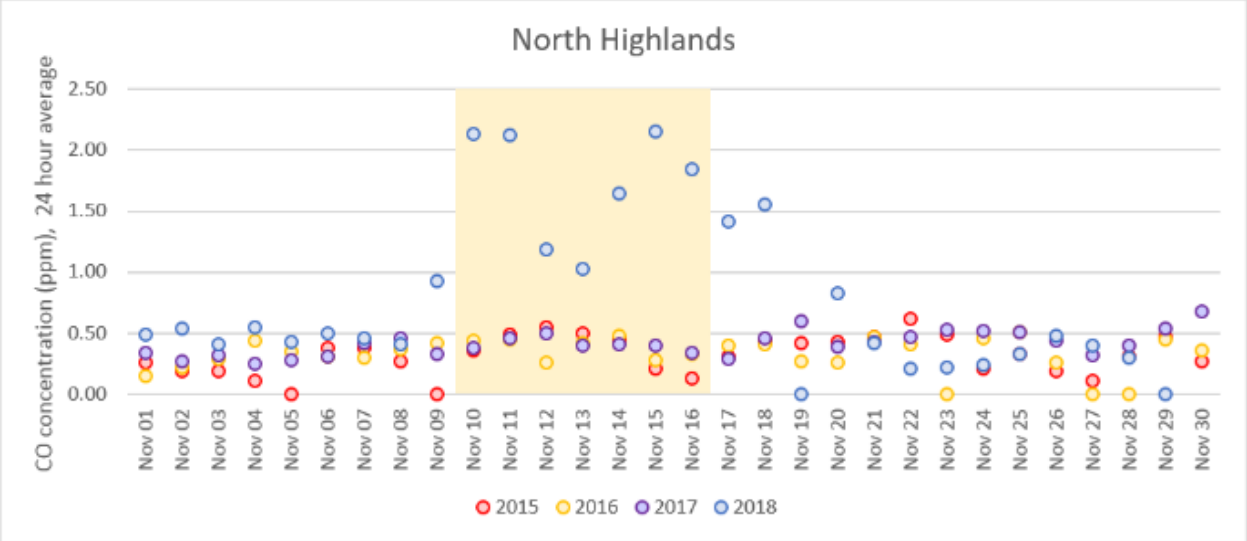
Figure 4-8a and 4-8b show Carbon Monoxide (CO) concentrations at Sacramento-Del Paso Manor and North Highland-Blackfoot Way, respectively, during November from 2015 through 2019. The highest CO concentrations recorded during this period were during the CAMP. The concentrations recorded during November 2018 (shown in blue) during the CAMP were significantly higher than the concentrations in the other years (2015 -2017 and 2019). Figure 4-8c shows black carbon (BC) concentrations at Sacramento - Del Paso Manor during November from 2015 through 2019. The highest BC concentrations recorded were also during the CAMP. In addition to the BC, organic carbon (OC) from speciated $PM_{2.5}$ data is shown from Del Paso Manor in Figure 4-8d. Similar to BC, the highest OC concentrations recorded were during the CAMP. The BC and OC concentrations were elevated throughout the period of the event and tapered off as the smoke dissipated from the region. The days in the area highlighted in brown are noted because these days are the exceedance days.

Figures 4-6(a-d) Carbon Monoxide, Black Carbon and Organic Carbon concentrations during November 2015 – 2019

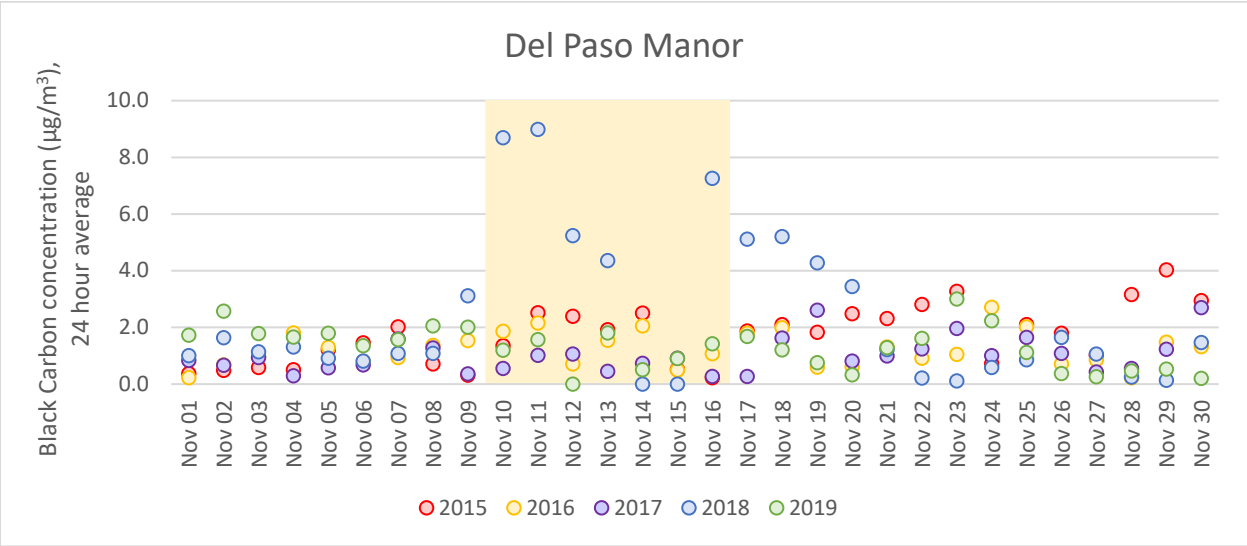
a. Carbon Monoxide concentrations at Del Paso Manor



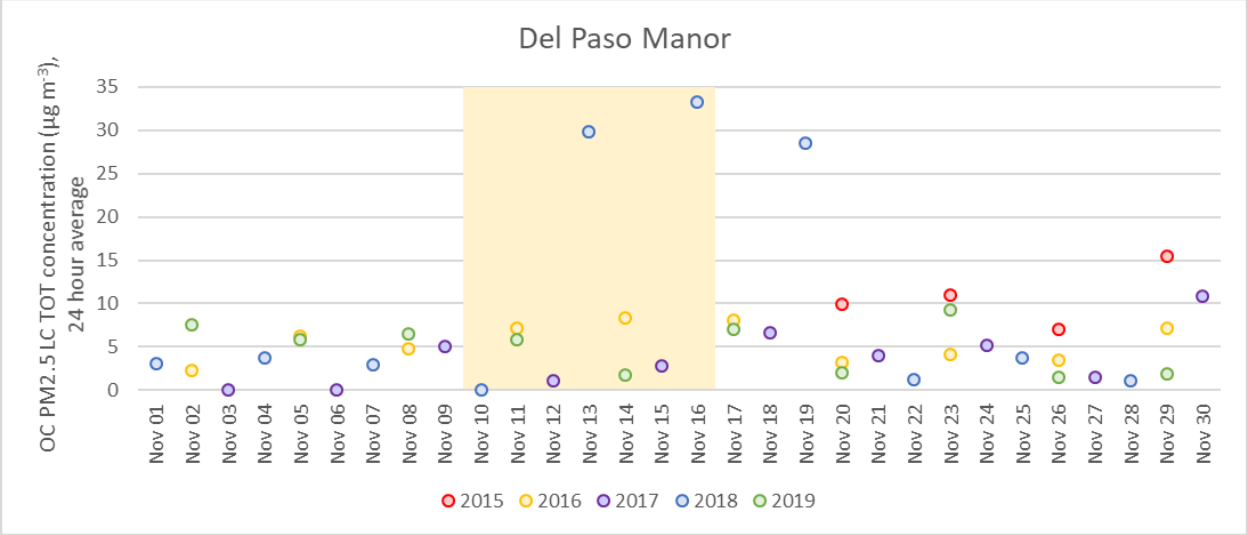
b. Carbon Monoxide concentrations at North Highlands



c. Black carbon concentrations at Del Paso Manor



d. Organic carbon* concentrations at Del Paso Manor



* Organic carbon data is from Chemical Speciation Network data operating on a 1 in 3 day schedule.

4.6. Summary of Clear Causal Relationship

The weight of evidence provided in this report has shown that smoke from the Camp Fire Wildfire on November 10, 11, 12, 14, 15 and 16 in 2018 caused PM_{10} concentrations in Sacramento County to be above the NAAQS of 150 ug/m^3. The monitored PM_{10} concentrations during the event when the six exceedances days were recorded were 4 to 5 times higher than the non-event PM_{10} concentrations from November 2015-2017. Additional information, provided below, supports the District's position that there exists a clear causal relationship between the specific event and the monitored exceedances and violation and thus, satisfies the clear causal relationship criterion.

- Except for one exceedance in 2019, the only exceedances and violations of the PM_{10} standard over the past 5 years (2015 – 2019) in Sacramento County have been due to smoke from the CAMP.

- Satellite Imagery and 24-Hour HYSPLIT Backward Trajectories show that CAMP is responsible for the smoke impacts seen in the PM_{10} Maintenance area boundaries.
- Satellite imagery and maps of the geographic extent of the PM_{10} concentrations show that areas impacted by smoke include and extend beyond Sacramento County and that exceedances and violations of the PM_{10} regulatory standard occurred north, south, east and west of the boundaries of the PM_{10} Maintenance Area.
- News articles, reports, and pictures (Appendix A) demonstrate the extent and severity of air quality problems caused by CAMP.
- Air Quality Index levels (Appendix C) and Air Quality Advisories issued by the District (Appendix D) show that air quality was at unhealthy levels during the exceptional events.
- Emissions from residential wood combustion were not the cause of the exceedances.
- Carbon monoxide, Black Carbon and Organic Carbon concentrations were elevated at monitors in Sacramento County during the exceptional events, which are other indictors of wildfire smoke impacts.

5. Not Reasonably Controllable or Not Reasonably Preventable

Section 40 CFR 50.14 (c)(3)(iv)(D) requires a demonstration that the event was both not reasonably controllable and not reasonably preventable. For wildfires, it is presumed according to 40 CFR 50.14(b)(4) that wildfires on wildland will satisfy both factors of the not reasonably controllable or not reasonably preventable unless there is evidence that demonstrates otherwise. As stated in 40 CFR 50.14(b)(4):

> The Administrator shall exclude data from use in determinations of exceedances and violations where a State demonstrates to the Administrator's satisfaction that emissions from wildfires caused a specific air pollution concentration in excess of one or more national ambient air quality standard at a particular air quality monitoring location and otherwise satisfies the requirements of this section. Provided the Administrator determines that there is no compelling evidence to the contrary in the record, the Administrator will determine every wildfire occurring predominantly on wildland to have met the requirements identified in paragraph (c)(3)(iv)(D) of this section regarding the not reasonably controllable or preventable criterion.

The California Department of Forestry and Fire Protection (CAL FIRE) reported the CAMP on November 8, 2018 as a wildland fire (Cal Public Utilities Commission, 2018). The fire was reported at Pulga Road at Camp Creek Road near Jarbo Gap in Butte County. This area where CAMP started meets the definition of a wildland area[12]. It is a forested area in unincorporated Butte County either on or very close to the national forest before spreading to private property to the west. The City of Paradise (as well as many of the other communities where the wildfire burned through) are in the foothills of the Sierra Nevada range and are up against the forest in the wildland-urban interface (WUI)[13](Meigs, 2018). The CAMP was determined to be a wildfire because it burned predominantly on wildland.

The District also explored other potential causes for the smoke, such as the potential for wood burning but found the high $PM_{2.5}$ concentrations were not likely from residential wood combustion. During the CAMP, all residential wood burning activities were banned. The District also did an assessment of auxiliary air quality data and found high Carbon Monoxide, Black Carbon and Organic Carbon concentrations, which are other indicators of wildfire smoke impacts.

The District determined that the smoke came from CAMP and that the CAMP was a natural, wildfire smoke event, and therefore, met the not reasonably controllable and not reasonably preventable criterion in the Exceptional Event Rule. The CAMP occurrence could not have been prevented and could not have been controlled, and there were no contributions of event related emissions from anthropogenic emissions as demonstrated in the clear causal relationship.

[12] Title 40 CFR § 50.1 defines wildland as an area in which human activity and development are essentially non-existent, except for roads, railroads, power lines, and similar transportation facilities. Structures, if any, are widely scattered.

[13] Department of Agriculture defines the WUI as the area where structures and other human development meet or intermingle with undeveloped wildland.

6. Human Activity Unlikely to Recur at a Particular Location or Natural Event

The Exceptional Event Rule requires a demonstration that the event was a human activity that is unlikely to recur at a particular location or was a natural event (40 CFR 50.14(c)(3)(iv)(E)). In the Exceptional Event Rule, EPA clarifies that an event could be considered a natural event[14] by applying the reasonable interpretation that the anthropogenic source had ''little'' direct causal role. The rule further explains that a wildfire is a natural event even though the wildfire may be initiated by accidental human actions. In addition, the CAMP meets the definition of "wildfire" in 40 CFR 50.1(n):

> A wildfire is any fire started by an unplanned ignition caused by lightning; volcanoes; other acts of nature; unauthorized activity; or accidental, human-caused actions, or a prescribed fire that has developed into a wildfire. A wildfire that predominantly occurs on wildland is a natural event.

As discussed in Section 3.1 (Camp Fire Overview) and Section 5 (Not Reasonably Controllable or Preventable), the CAMP was a result of an accidental electrical transmission line failure and burned predominantly on wildland. Per the Exceptional Event Rule, the CAMP is a natural event and may be considered for treatment as an exceptional event.

[14] EPA's definition of natural event (81 FR 68231), ''natural event means an event and its resulting emissions, which may recur at the same location, in which human activity plays little or no direct causal role. For purposes of the definition of a natural event, anthropogenic sources that are reasonably controlled shall be considered to not play a direct role in causing emissions.''

7. Public Notification

The Sac Metro Air District will hold a 30-day public comment period to get public comment regarding the Exceptional Events Demonstration Plan. Notification of the public comment period will be posted on the Sacramento Metropolitan Air Quality Management District website and emailed to interested stakeholders. Public comments and responses will be included in Appendix E.

8. Summary and Conclusions

The Camp Fire Wildfire (CAMP), located 60 miles north of Sacramento, was the most devastating wildfire experienced in California up to that year. On November 8, 2018, the CAMP was ignited, and it quickly spread due to dry conditions from a lack of precipitation and gusty winds. Heavy gusts transported the smoke into communities downwind of the fire, including into Sacramento County. The wildfire continued to burn until it was fully contained on November 25, 2018.

During this wildfire event, heavy smoke was transported into many counties, including Sacramento County, where smoke was extremely thick and remained for several days. The monitors in Sacramento recorded elevated concentrations of pollutants, including PM_{10}. This analysis demonstrated that the CAMP caused the Sacramento County to experience extremely high PM_{10} concentrations, which exceeded the regulatory 24-hour PM_{10} standard of 150 $\mu g/m^3$ on November 10, 11, 12, 14, 15 and 16 in 2018. These exceedances were the only PM_{10} exceedances along with one exceedance in 2019 that the county has had since 2006, and they caused the county to violate the standard. In addition, the average PM_{10} concentrations in November 2018 were much higher than normal when compared to the average concentration for the same month in 2015, 2016, 2017, and 2019.

Satellite images from each exceedance day showed the presence of a large smoke plume that extended into Sacramento County. The 24-Hour HYSPLIT backward trajectory modeling showed that air flow to the T-Street air monitoring stations was from the north to northwest where the CAMP was located. Transport of smoke into downwind areas created unhealthy air quality levels in the county as determined by the forecasted and measured concentrations, provided by air quality alerts and advisories, and covered by the media. This analysis also showed that the geographic extent of the PM_{10} air quality impacts for each exceedance day included and extended well beyond Sacramento County. The CAMP was not reasonable controllable or preventable because the CAMP occurred predominantly on wildlands.

This exceptional event demonstration plan provided evidence that meets the requirements in the Exceptional Event Rule under 40 CFR 50.14 (3)(iv)(A–E). The Sac Metro Air District is requesting EPA's concurrence that the violations in November 2018 of the PM_{10} 24-hour National Ambient Air Quality Standard were a result of an exceptional event. The District requests that the PM_{10} monitoring day exceedances on November 10, 11, 12, 14, 15 and 16 in 2018 in Sacramento County should not be used to calculate the 2017 – 2019 design value for the District's PM_{10} Second Maintenance Plan. With EPA's concurrence, Sacramento County will continue to show attainment of the PM_{10} standard and move forward with the Second 10-year PM_{10} Maintenance Plan.

9. References

Battye W. & Battye R. *Development of Emissions Inventory Methods for Wildland Fire Final Report. EPA Contract No. 68-D-98–046. Work Assignment No. 5-03.* Durham, North Carolina: EC/R Incorporated, [2002.] Web. 20 March 2020. < https://www3.epa.gov/ttnchie1/ap42/ch13/related/firerept.pdf >.

Boxall, Bettina. *Climate change will make California's drought-flood cycle more volatile, study finds*. Los Angeles, CA: Los Angeles Time. 18 April 2018. Web. 19 March 2020. < https://www.latimes.com/local/lanow/la-me-drought-flood-20180423-story.html >

Brewer, MJ and Clements, Craig B. *The 2018 Camp Fire: Meteorological Analysis Using In Situ Observations and Numerical Simulations*. 29 December [2019.] Web. 15 April 2020. < https://www.mdpi.com/2073y -4433/11/1/47/pdf >

Cal Fire (2018). Daily Videos of Campfire Wildfire Incident Mangagemnt Reports. You Tube - Camp Fire Live Press Conference (November 9, 2018 – November 16, 2018). Web. 15 September 2020. < https://www.youtube.com/watch?v=xOsp17CTLiM >.

---. (2019). *CAL FIRE Investigators Determine Cause of the Camp Fire.* California Department of Forestry and Fire Protection (Cal Fire). 15 May, [2019.] Web. 19 March 2020. < https://www.fire.ca.gov/media/5121/campfire_cause.pdf >.

California Air Resource Board (CARB) *Annual Network Plan. Covering Monitoring Operations in 25 California Air Districts.* Sacramento, CA: California Air Resource Board. 6 July 2020. Web. 9 September 2020. < https://ww3.arb.ca.gov/aqd/amnr/2020anp.pdf >

California Public Utilities Commission (CPUC), 2018, Appendix A of CPUC Safety Enforcement Division (SED) Camp Fire Investigations Report < ftp://ftp.cpuc.ca.gov/News_and_Outreach/I1906015%20Appendix%20A%20SED%20Camp%20Fire%20Investigation%20Report%20REDACTED.pdf >

Di Liberto, Tom. "Hot, dry summer and slow to wet season primed California for November 2018 fires." National Oceanic and Atmospheric Administration. 16 November [2018.] Web. 15 April 2020. < https://www.climate.gov/news-features/event-tracker/hot-dry-summer-and-slow-start-wet-season-primed-california-november-2018>

Lin, Rong-Gong, et al. *As autumn rain in California vanishes amid global warming, files worsen.* Los Angeles, CA: Los Angeles Time. 13 November 2018. Web. 19 March 2020. < https://www.latimes.com/local/lanow/la-me-drought-flood-20180423-story.html >

McCough, Michael. "All Sacramento-area schools shut this week, due to smoke or holiday. Here's when they plan to reopen." Sacramento, CA: The Sacramento Bee. 19 November, 2018. Web. 19 March 2018. < https://www.sacbee.com/news/california/fires/article221899440.html >

Meigs, James. "Living On The Edge." Slate.com. November 2018 < https://slate.com/technology/2018/11/camp-fire-disaster-causes-urban-wildland-interface.html >

NASA. "NASA/NOAA Satellites Capture Smoke Transport from California Wildfires". NASA Earth Science Disasters Program. 10 November 2018. Web. 15 April 2020.

<https://disasters.nasa.gov/november-2018-california-wildfires/nasanoaa-satellites-capture-smoke-transport-california-wildfires>

---. "Moderate Resolution Imaging Spectroradiometer." Web. 20 March 2020. < https://modis.gsfc.nasa.gov/ >.

National Wildfire Coordinating Group. "Glossary". Web. 14 April 2020. < https://www.nwcg.gov/term/glossary/upper-level-ridge >

NWS. Forecast Office. "Sacramento, CA. Historical Archives Daily Weather Maps." Web. 15 April 2020a.< https://w2.weather.gov/climate/xmacis.php?wfo=sto >

---. "WPC Surface Analysis Archive." College Park, MD: NOAA/National Weather Service, National Centers for Environmental Protection. Weather Prediction Center. Web. 7 April 2020b < https://www.wpc.ncep.noaa.gov/archives/web_pages/sfc/sfc_archive_maps.php?arcdate=11/11/2018&selmap=2018111100&maptype=namussfc >

National Weather Service Weather Prediction Center (NWS WPC, 2020). "National Forecast Chart". Web.15 April 2020. < https://www.wpc.ncep.noaa.gov/#page=ovw>

NOAA. "County Average Temperature Ranks, June-August 2018, Period: 1895-2018" Web 15 April 2020. <https://www.ncdc.noaa.gov/monitoring-content/sotc/national/2018/aug/countytavgrank-201806-201808.gif >

---. "Air Resources Laboratory. Advancing Atmospheric Science and Technology through Research." National Oceanic and Atmospheric Administration. 4 December 2019. Web. 20 March 2020. < https://www.ready.noaa.gov/HYSPLIT.php >.

Sac Metro Air District. *PM_{10} Implementation/Maintenance Plan and Resignation Request for Sacramento County (with errata sheet incorporated).* Sacramento, CA: Sacramento Metropolitan Air Quality Management District, 28 October, [2010.] Print.

---. *2020 Annual Monitoring Network Plan.* Sacramento, CA: Sacramento Metropolitan Air Quality Management District. 10 October, [2020a.] Print.

---. *Check Before You Burn Season History.* Sacramento, CA: Sacramento Metropolitan Air Quality Management District. Web. 6 October 2020. <http://www.airquality.org/Residents/Fireplaces-Wood-Stoves/Check-Before-You-Burn/Check-Before-You-Burn-History >

Simon, Matt. *These Wind Patterns Explain Why California's Wildfires Are So Bad.* Wired Magazine. 11 November, 2018a. Web. 19 March 2020 < https://www.wired.com/story/these-wind-patterns-explain-why-californias-wildfires-are-so-bad/?verso=true >

---. *The Terrifying Science Behind California's Massive Camp Fire.* Wired Magazine. 9 November, 2018b. Web. 19 March 2020 < https://www.wired.com/story/the-terrifying-science-behind-californias-massive-camp-fire/ >

USEPA. (58 FR 67334). *Designation of Areas for Air Quality Planning Purposes*. Federal Register, Volume 58, December 21, 1993, p. 67334.

---. (62 FR 38652-38760) *National Ambient Air Quality Standards for Particulate Matter*. Federal Register, Volume 62, July 18, 1997, p. 38652-38760.

---. (67 FR 7082 – 7085). *Clean Air Act Attainment Finding; Bullhead City and Payson Nonattainment Areas, AZ; Sacramento and San Bernardino Nonattainment Areas, CA; Particulate Matter of 10 Microns or Less (PM-10)*, Federal Register, Volume 67, February 15, 2002, p. 7082-7085.

---. (71 FR 61144 – 61233) *National Ambient Air Quality Standards for Particulate Matter*. Federal Register, Volume 71, October 17, 2006, p. 61144-61233.

---. (78 FR 59261 – 59263), *Approval and Promulgation of Implementation Plans; Designation of Areas for Air Quality Planning Purposes; State of California; PM_{10}; Resignation of Sacramento to Attainment; Approval of PM_{10} Resignation Request and Maintenance Plan for Sacramento*, Federal Register, Volume 78, September 26, 2013, p. 59261-59263.

---. (81 FR 68216 – 68282) *Treatment of Data Influenced by Exceptional Events*. Federal Register, Volume 81, October 3, 2016, p. 68216-68282.

---. *Definitions*, Title 40, Code of Federal Regulations Part 50 §1 (2016.)

---. *Treatment of air quality monitoring data influenced by exceptional events*, Title 40, Code of Federal Regulations Part 50 §14 (2016.)

---. *Interpretation of the National Ambient Air Quality Standards for Particulate Matter*. Title 40, Code of Federal Regulations Appendix K to Part 50 (2016.)

---. Wildfire Smoke – A guide for Public Health Officials. 2001
< https://www3.epa.gov/ttnamti1/files/ambient/smoke/wildgd.pdf >

---. Yoshimura, G. "EPA Response to CARB Initial Notification for 2018 Exceptional Events in Sacramento Metro $PM_{2.5}$ NAA" Message to Sylvia Vander speck, CARB. 2 October 2019. E-mail.

---. *Treatment of Air Quality Data Influenced by Exceptional Events (Homepage for Exceptional Events)*. Web. 14 April 2020a < https://www.epa.gov/air-quality-analysis/treatment-air-quality-data-influenced-exceptional-events-homepage-exceptional >

---. *AirNow-Tech.* United States Environmental Protection Agency. Web 20 March 2020b < https://www.airnowtech.org/ >.

Appendix A Media Reports on the Fire

Appendix A shows newspaper articles and stories, Twitter posts, and other media reports which describe the smoke impacts and air quality impacts that resulted from the fire. Articles also describe the meteorology which caused the fire to spread rapidly and the smoke to become unhealthy for some of the most populated areas in California.

Start of the Wildfire

Camp Fire smoke has hit Sacramento. How bad is the air?

Anna Buchmann, Sacramento Bee (November 9, 2018)

Pushed by north winds, smoke from the devastating Butte County wildfire hung over the Sacramento region on Friday and was likely to affect air quality over the weekend and into next week, officials reported.

Air particle levels in the Sacramento region were expected to be unhealthy for sensitive groups on Friday, according to the Spare the Air website for the Sacramento region, worsening to unhealthy levels Saturday and returning to unhealthy for sensitive groups Sunday and Monday.

Air quality officials advise that when you smell or see smoke, you should stay indoors and minimize your exposure by shutting doors and windows. If you must be outdoors, they also advise limiting strenuous activity.

"Winds will be light for the rest of today and into Saturday," said Jim Mathews, a forecaster with the Sacramento office of the National Weather Service. The smoke was expected to gradually shift northward away from the Sacramento region Friday afternoon, he said, but drift back toward the city Saturday.

"(S)tronger winds are unfortunately forecast to develop Saturday night into Sunday," Mathews said, with gusts up to 30 mph from the north possible. The weather service warned that the wind will renew critical fire weather conditions. "Smoke likely will spread to the southwest again from the Camp Fire along the coast," Mathews said.

Winds are then expected to weaken Sunday night and Monday, with breezes of 5 mph out of the north. "We're probably going to have some smoky conditions at times in the Sacramento area over the weekend at least into Monday," Mathews said.

Smoke from the Camp Fire affects air quality in Sacramento (November 10, 2018) (Source Daniel Kim at SacBee)

Fire Paradise: Embers fly as wind as wind and flames from the Camp Fire tear through Paradise, (Source: Josh Edelson/AFP/Getty Images)

These Wind Patterns Explain Why California's Wildfires Are So Bad

Matt Simon, Wired Magazine (November 11, 2018)

The Camp Fire, Hill Fire, and Woolsey Fire share an origin in the jet stream, which has produced extreme winds that are spreading the flames and hampering firefighting efforts.

In California three major fires—the Camp Fire in the north and Hill Fire and Woolsey Fire in the south—have raged on a scale the state has never seen before. The Camp Fire was the most destructive and deadliest wildfire in California history by far: It has virtually obliterated the 27,000-person town of Paradise, destroying almost 19,000 structures and killing at least 88. Hundreds of people are still missing. Three people have been found dead in the Woolsey Fire.

The driving force has been extreme wind—gusts of up to 60 miles per hour, perhaps even 70 in the hills of Southern California—blowing through the state. Wind further desiccates already dry vegetation and pushes the fires along with incredible speed. Like a demonic analog of water, this air is flowing across the state, nourishing flames and parching plants.

The fire-fanning winds originate in the jet stream, a band of strong winds in the upper reaches of the atmosphere. The jet stream strengthens at this time of year, amplifying its natural meandering nature and creating troughs that move south through California, which you can see in the tweet below.

@NWSBayArea. "" *Twitter,* 11 November, 2018, 8:30 am.

That's why all these fires popped up on either end of the state nearly simultaneously: They share a common origin in the jet stream.

When the air masses hit the Sierra Nevada Mountains in eastern California, they behave like water flowing over a rock in a stream. In fluid dynamics it's known as a hydraulic jump—the water picks up speed as it cascades down the rock.

Or in this case, air. "You get an enhancement of the wind and the momentum as it compresses," says Nick Nauslar, a fire weather forecaster at NOAA. "As it gets compressed it expands and warms, and so you get a warming, a drying, and an enhancing of the wind speed." That warm air moves across the ground and sucks the moisture out of already parched vegetation, making it that much easier for a spark to turn to flame.

But how did the winds form in the first place? This comes back to the jet stream and the inland high-pressure regions it generated. Air generally moves from high to low pressure, and in this case the low-pressure area off the California coast pulls winds to the west. "The stronger the pressure gradient, the stronger your winds will be at the surface," says Nauslar.

To get a sense of the physics at play, picture a plastic bottle of water. "If you have a water bottle and you squeeze one side, applying more pressure, you're increasing the gradient of pressure from the back end to the front end, and the water squirts out," says Nauslar. "Essentially you're propelling the air, or in this case water, forward at a faster rate." Change the pressure gradient, and you change wind speed, which is why we've seen fluctuations rippling south through California like waves.

High winds make the fires more dangerous by speeding them up and further drying out vegetation. (The tweet below shows just how quickly the winds can crater humidity and spike temperatures.) But it also makes firefighters' jobs harder.

Firefighters on the ground have to keep their distance if the conflagration is moving too fast, or it will overwhelm them. Particularly high winds will either ground aircraft or mess with their accuracy when doing aerial drops of water or fire retardant. "It's not as impactful because the retardant gets spread out too far or it misses its area," says Nauslar.

Crews will still try drops if winds aren't too high to fly aircraft, especially if there are structures or lives at risk. Indeed, helicopters have been dipping into Malibu mansions' pools, despite the winds. The drops just might not be as effective as they would be in calmer conditions.

Even *if* the wind were to die down significantly, as it sometimes does at night (though not in the case of these fires—gusts waned, but still a wind of some sort is probably blowing), smoke problems are likely to persist. "You'll get what is called an inversion that begins to settle," says Nauslar, a condition where hot air parks itself above cooler air. "It traps smoke at lower levels, and that's where you can really get some communities that are smoked in with some very unhealthy air quality, especially in areas that are directly downstream or in the vicinity of the fires."

The sad and horrifying reality is that this is the new California. In just the last year, the state has seen seven of the 20 most destructive fires in its history. The warmer the planet gets, the thirstier California's atmosphere gets, the drier the vegetation gets, and the worse fires rage.

Meteorologist Explains the California Fires—And Scoffs at Trump's Claims

Don Reisinger, Fortune (November 12, 2018)

CNN meteorologist Tom Sater over the weekend explained in detail why the California wildfires are happening and how they've burned out of control in a rebuke to Trump's tweet. He said that forest mismanagement is not at all a contributing factor and, citing a tweet he saw over the weekend, suggested that Trump's warning of pulling federal payments unless management improves is like pulling federal funding from the National Hurricane Center "until you stop all these hurricanes. It's the same notion."

From there, Sater went into a three-minute, science-based explanation on the California wildfires. He noted that humidity is extremely low, rainfall is at dangerously low levels, and winds on Thursday picked up, creating the recipe for the wildfires to spread. Meanwhile, rescue workers and firefighters have been working around the clock to save lives and preserve as many homes and businesses as possible.

Sater also dug into the history of California wildfires and noted that the Tunnel Fire of 1991 was the only major California wildfire before 2003 to land in the top ten of most destructive California wildfires. This year's Camp Fire is already the most destructive in California's history.

Looking ahead, Sater said that winds in mountain passes are expected to pick up again, which could cause more problems. And at the end of his analysis, he again said that forest mismanagement is not at all a problem in this fire.

After his initial tweet on the fires, Trump posted three more over the weekend. The first in the new batch honored the thousands of people fighting the fires and remembered those who have died. Another asked that people evacuate when they receive orders from state and local officials. On Sunday, however, he went back to the mismanagement tack.

Smoke from Camp Fire Blankets Sacramento Area, Creating Hazardous Air Quality

Sacramento CBS13 (November 12, 2018)

Air quality index over 300 is considered hazardous; this weekend in Roseville it reached 498 – the max is 500. It's why people are being asked to stay indoors or wear respiratory masks

It's a hard ask many who have outdoor plans like Aaron Castillo.

"When I get out of my truck and I get back in it and there's just ash everywhere," Castillo said.

Shoppers out and about in Roseville say the smell of smoke is hard to miss, among other side effects.

"It's definitely creating a cough. A lot of people coughing, my throats been hurting," said Jenna Blakely.

It's all effects from the Camp Fire which broke out on Thursday.

"Yesterday was much worse. I live up in Marysville in Yuba City and I didn't go outside at all and I have a friend who's pregnant and she wore a mask and everybody was just staying inside," said Kirstynn Macias.

That's exactly what the City of Sacramento Fire Department is asking people to do: Stay indoors.

"We absolutely advise adhering to county public health recommendations to that the primary method to protect yourself is to stay indoors and limit outside exercise activity," said Daniel Bowers, Director of Emergency Management.

The fire department is distributing thousands of these masks, free of charge to the public. The masks are available at every fire station in the city. They've also been given to homeless advocacy groups.

"Understandably they spend a majority of their time outdoors so this is a prudent step for us to provide this resource," Bowers said.

For those looking to purchase their own, it's important to buy one that "clearly states N95 or N100," he said.

Some residents say seeing people with masks on, puts the dangers of the Camp Fire into perspective.

"It's definitely scary and it's a constant reminder of everything that's going on," Blakely said.

For those looking for something to do indoors tomorrow with the kids, the Sacramento Children's Museum is open. They are offering price reductions. Admission is free of charge for veterans and those affected by the fire.

Public schools across the Bay Area will be closed Friday due to smoke hazard

McBride, Ashley; Wu, Gwendolyn San Francisco Chronicle, (November 15, 2018)

Bay Area air quality has deteriorated to even unhealthier levels as smoke from the Camp Fire settled over the region Thursday (November 15, 2018), prompting dozens of school districts to close for the rest of the week. Earlier Thursday, the National Weather Service issued a forecast predicting that smoke would linger in the area through next week. All public schools in San Francisco, Alameda, Contra Costa, Solano, and Marin counties canceled Friday classes, citing poor air quality. Data from the Bay Area Air Quality Management District indicates that San Francisco and parts of the East Bay dipped from “red” to “purple” levels, which indicates that particulate matter could affect respiratory conditions for all residents.

Photo: Kathleen Watson

IMAGE 1 OF 65

Smoke from the Camp Fire filled the air in Sacramento on Nov. 15, 2018.

Bridge in Sacramento shows smoke from Camp Fire (90 miles away) Source: Andrew Nixon / Capital Public Radio (November 15, 2018)

When Will Air Quality Improve In the Bay Area

Katie Dowd and Amy Gaff, SFGATE (November 16, 2018)

As air quality measures dance near all-time-highs around California, Bay Area residents are looking for relief from smoky skies.

"The air quality will likely be worse Friday, (November 16, 2018)" said Kristine Roselius, a spokesperson for the Bay Area Air Quality Management District. "We'll see readings in the 'unhealthy' to 'very unhealthy' range."

Conditions don't look much better for the rest of the weekend. Meteorologists believe Saturday will also have unhealthy air quality, with winds finally picking up on Sunday. A weather system that could bring rain to the Bay Area should sweep in later in the week, clearing out more smoke from the Camp Fire, burning 200 miles away in Butte County.

Air quality measures all over the Bay Area were cresting over 200 on Thursday, a range considered "very unhealthy." People with respiratory issues, such as asthma, should avoid outdoor activity. All people, particularly children, should avoid prolonged outdoor exertion

National Weather Service meteorologist Drew Peterson says smoke from the fire is filling the Sacramento Valley, creating a deep reservoir of polluted air. The current weather pattern has a light wind gently pushing the smoke from the valley to the southwest toward the Delta. When the smoke hits this narrower opening in the valley, it fans out, spreading across the Bay Area. Here the air is stagnant, and little smoke is escaping through the Golden Gate's skinny opening.

Smoke from Camp Fire Making Sacramento the Most Polluted City on Earth

Jeff Masters, Weather Underground (November 16, 2018)

Smoke from California's Camp Fire has settled into Central California's valleys and cities and refuses to leave, like a bad case of bronchitis one simply can't shake. On Friday, the pollution became so severe that all schools in the San Francisco Bay area were closed, including area colleges, and the city's iconic cable cars were taken out of service. The state capitol, Sacramento, also closed all of its schools. This is a rare and extremely dangerous air pollution episode, and I'm not familiar with a case where a major U.S. city shut down all its schools for wildfire smoke. A Berkeley Earth website that tracks global pollution levels has consistently shown Sacramento, California as having the worst air pollution for any major city on Earth over the past day, beating out the big cities in India and China that usually hold that position.

On Thursday (November 15, 2018) at EPA's monitor in downtown San Francisco at 10 Arkansas Street, the 24-hour $PM_{2.5}$ level was 145 µg/m3. That's about four times higher than the 24-hour standard of 35 µg/m3, and well into the purple "Very Unhealthy" air regime. In EPA's on-line records that extend back to 1999, the previous highest 24-hour $PM_{2.5}$ levels measured in San Francisco were 76.6 $\mu g/m^3$ in 2001.

In Sacramento, the pollution was even more dire: the 24-hour $PM_{2.5}$ levels on Thursday were 263 $\mu g/m^3$. That's about seven times higher than the 24-hour $PM_{2.5}$ standard of 35 $\mu g/m^3$, and lies in the maroon "Hazardous" range—the highest level of danger on EPA's Air Quality Index (AQI) scale. At this level, EPA warns that "this would trigger a health warnings of emergency conditions." I'm not familiar with a past case of a major U.S. city experiencing a "Hazardous" air quality reading for 24-hour $PM_{2.5}$ levels from wildfire smoke.

@RARohde. "" *Twitter*, 15 November 2018, 11:15pm.

Robert Rohde
@RARohde

Follow

Our list of cities with the highest particulate (PM2.5) air pollution concentrations during the last hour is looking pretty bizarre. Five California cities in the top 15, #Sacramento as the worst in the world. #CaliforniaFires

berkeleyearth.lbl.gov/air-quality/Ci ...

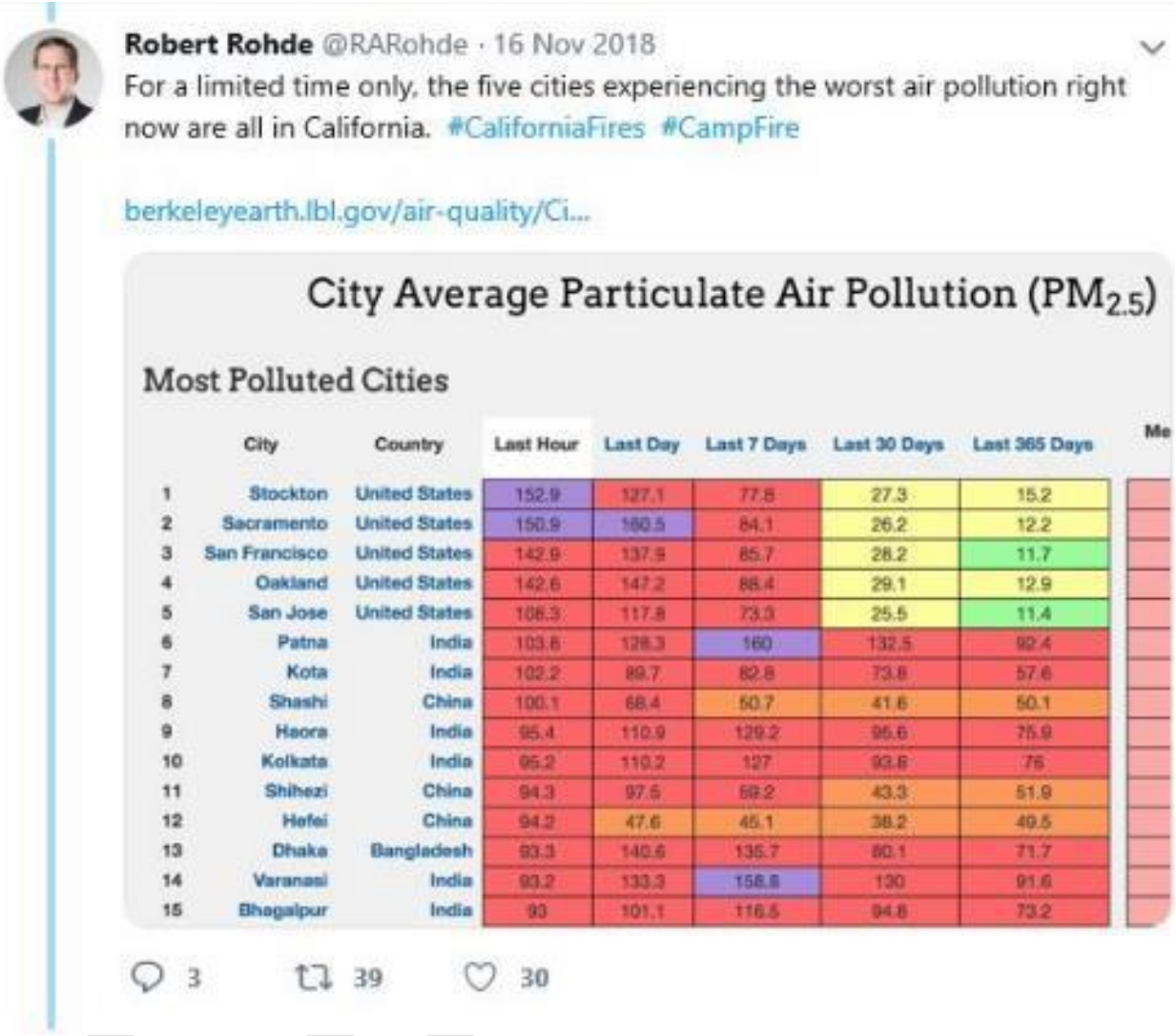
City Average Particulate Air Pollution ($PM_{2.5}$)

Most Polluted Cities

	City	Country	Last Hour	Last Day	Last 7 Days	Last 30 Days	Last 365 Days	Mo
1	Sacramento	United States	225.4	162.9	77.2	24.5	12.1	
2	Faridabad	India	183.8	122.9	173.4	173.8	100.8	
3	Greater Noida	India	173.5	128.3	186.5	184	102	
4	San Francisco	United States	170.5	126.3	80.4	26.5	11.6	
5	Agra	India	169.9	124	163.8	141.7	91.9	
6	Oakland	United States	166.4	141.7	84.3	27.9	12.8	
7	Mathura	India	154.3	115.3	149.7	136	88.5	
8	San Jose	United States	152.8	108.9	68.3	24.1	11.3	
9	Aligarh	India	150.4	117.7	166.2	152.5	92.5	
10	Firozabad	India	136.6	119.4	159.3	141.3	89.9	
11	New Delhi	India	130.3	127.3	197	177.5	105.5	
12	Stockton	United States	148.3	119.2	71.5	25.8	15	
13	Noida	India	142.7	123.8	203.1	186.8	102.2	
14	Xinyang	China	140.7	90.2	76.3	50.3	32.8	

11:15 PM - 15 Nov 2018

@RARohde. "" *Twitter*, 16 November 2018.



Robert Rohde @RARohde · 16 Nov 2018

For a limited time only, the five cities experiencing the worst air pollution right now are all in California. #CaliforniaFires #CampFire

berkeleyearth.lbl.gov/air-quality/Ci...

City Average Particulate Air Pollution ($PM_{2.5}$)

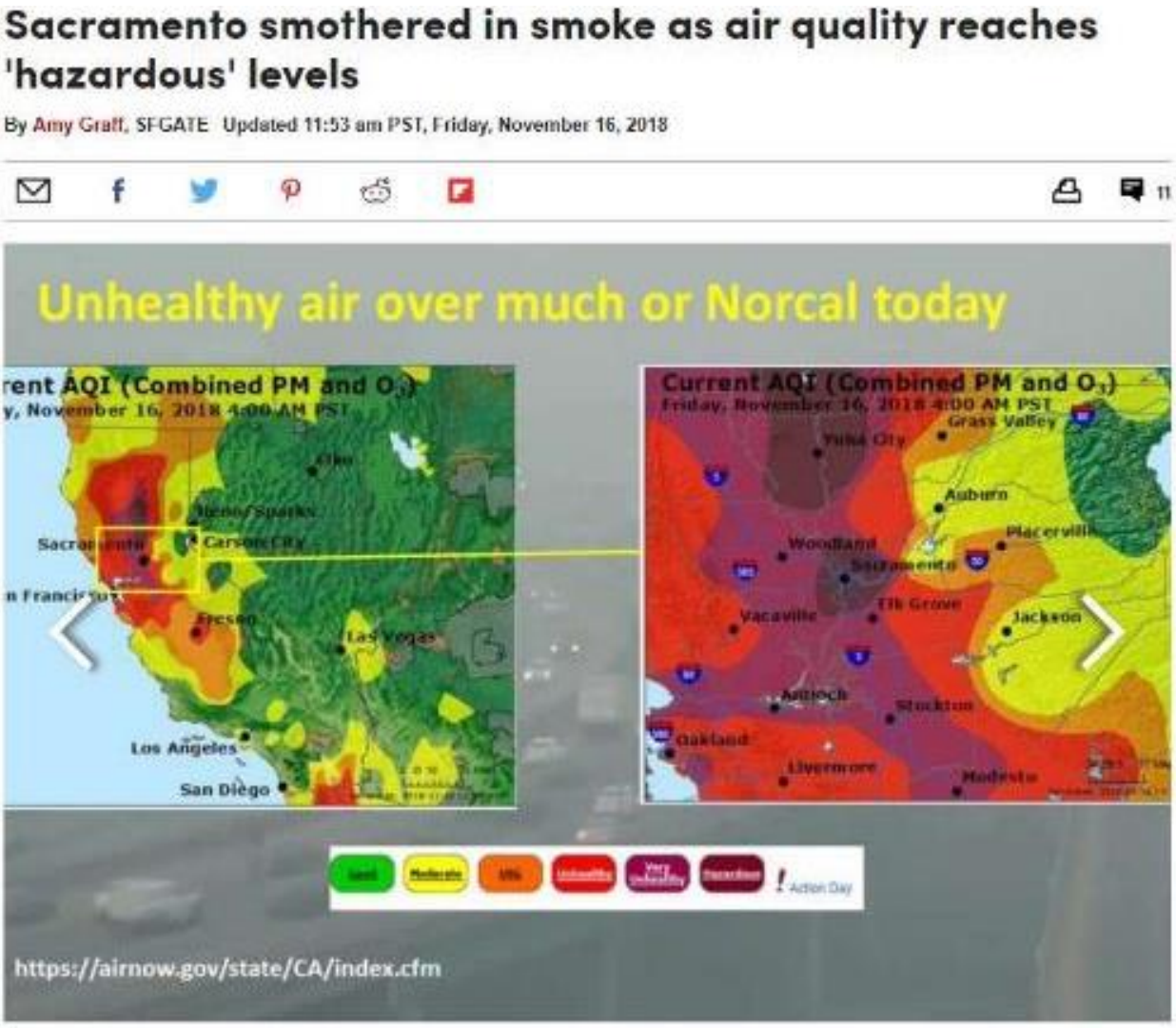
Most Polluted Cities

	City	Country	Last Hour	Last Day	Last 7 Days	Last 30 Days	Last 365 Days	Me
1	Stockton	United States	152.9	127.1	77.6	27.3	15.2	
2	Sacramento	United States	150.9	160.5	84.1	26.2	12.2	
3	San Francisco	United States	142.9	137.9	85.7	28.2	11.7	
4	Oakland	United States	142.6	147.2	88.4	29.1	12.9	
5	San Jose	United States	108.3	117.8	73.3	25.5	11.4	
6	Patna	India	103.6	128.3	160	132.5	92.4	
7	Kota	India	102.2	89.7	82.8	73.8	57.6	
8	Shashi	China	100.1	68.4	50.7	41.6	50.1	
9	Haora	India	95.4	110.9	129.2	95.6	75.9	
10	Kolkata	India	95.2	110.2	127	93.6	76	
11	Shihezi	China	94.3	97.5	69.2	43.3	51.9	
12	Hefei	China	94.2	47.6	45.1	38.2	49.5	
13	Dhaka	Bangladesh	93.3	140.6	135.7	80.1	71.7	
14	Varanasi	India	93.2	133.3	158.8	130	91.6	
15	Bhagalpur	India	93	101.1	116.5	94.8	73.2	

3 39 30

Sacramento smothered in smoke as air quality reaches 'hazardous' levels

Amy Graff, SF Gate (November 16, 2018)



Graff, Amy. "Sacramento smothered in smoke as air quality reaches 'hazardous' levels" *SFGATE* 16 November, 2018. Web. 20 March 2020 < https://www.sfgate.com/weather/article/Sacramento-smoke-air-quality-hazardous-Camp-Fire-13398500.php >

References

@NWSBayArea. “” Twitter, 11 November, 2018, 8:30 am.

@RARohde. “” *Twitter*, 15 November 2018, 11:15pm.

@RARohde. “” *Twitter*, 16 November 2018.

CBS13. “Smoke from Camp Fire Blankets Sacramento Area, Creating Hazardous Air Quality”. *CBS13*. 12 November, 2018. Web. 20 March 2020. < https://sacramento.cbslocal.com/2018/11/12/smoke-from-camp-fire-blankets-sacramento-area-creating-hazardous-air-quality/ >

Buchmann, Ann. “Camp Fire smoke has hit Sacramento. How bad is the air?” *Sacramento Bee* 9 November, 2018. Web. 20 March 2020. < https://www.sacbee.com/news/weather/article221422365.html >.

Graff, Amy. “Sacramento smothered in smoke as air quality reaches ‘hazardous’ levels” SFGATE 16 November, 2018. Web. 20 March 2020 < https://www.sfgate.com/weather/article/Sacramento-smoke-air-quality-hazardous-Camp-Fire-13398500.php >

Reisinger, Don. “Meteorologist Explains the California Fires—And Scoffs at Trump’s Claims”. *Fortune* 12 November, 2018. Web 19 March 2020. < https://fortune.com/2018/11/12/meteorologist-california-fire-donald-trump/ >

Simon, Matt. “These Wind Patterns Explain Why California’s Wildfires Are So Bad*”. Wired Magazine*. 11 November, 2018. Web. 19 March 2020 < https://www.wired.com/story/these-wind-patterns-explain-why-californias-wildfires-are-so-bad/?verso=true >

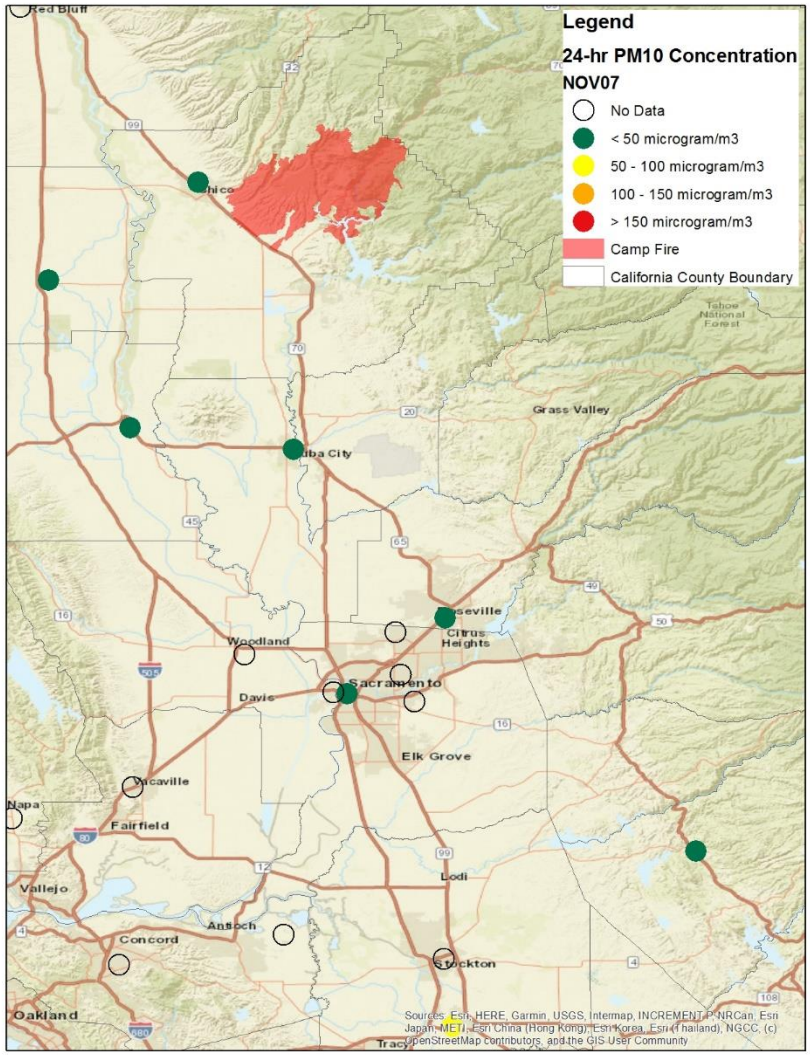
Masters, Jeff. “Smoke From Camp Fire Making Sacramento the Most Polluted City on Earth” *Weather Underground* 16 November 2018. Web. 20 March 2020. < https://www.wunderground.com/cat6/Smoke-Camp-Fire-Making-Sacramento-Most-Polluted-City-Earth >.

McBride, Ashely et al. "Public schools across the Bay Area will be closed Friday due to smoke hazard." *San Francisco Chronicle* 15 November 2018. Web. 20 March 2020. < https://www.sfchronicle.com/california-wildfires/article/Smoke-hazard-forces-dozens-of-Bay-Area-schools-to-13396652.php >

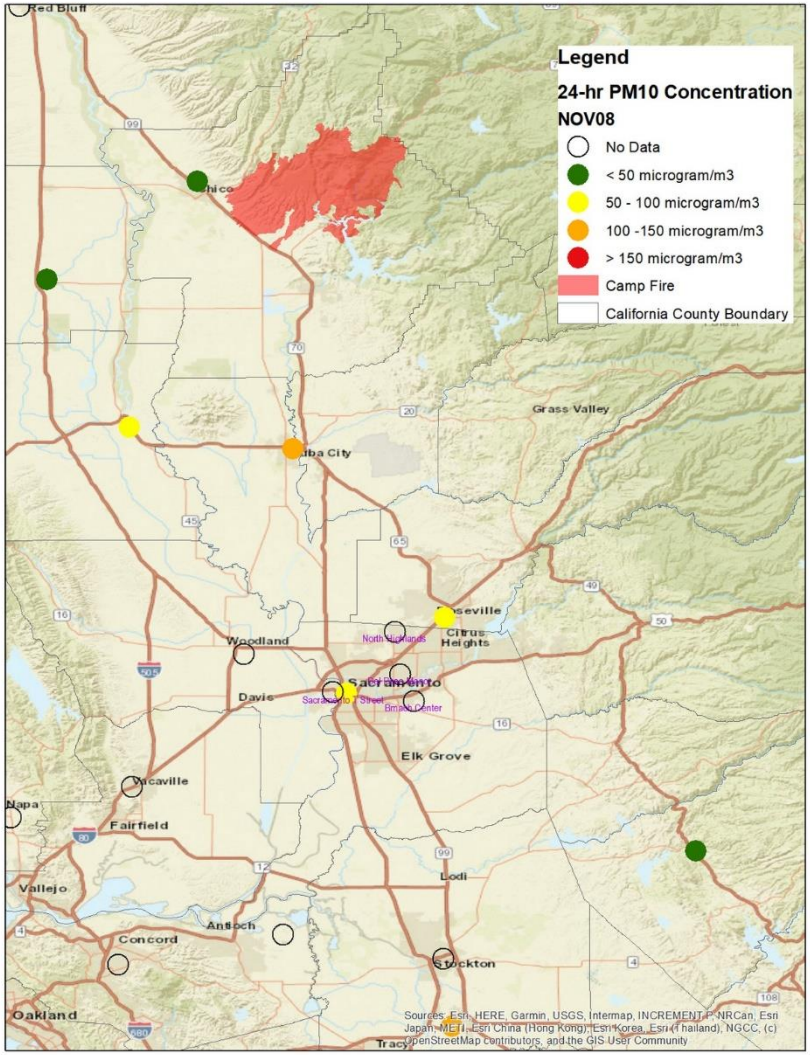
Dowd, Katie. And Gaff, Amy. “When Will Air Quality Improve In the Bay Area” *SFGATE* 16 November 2018. Web 20 March 2020. < https://www.sfgate.com/california-wildfires/article/camp-fire-wildfire-smoke-sf-california-wind-13396555.php >.

Appendix B Geographic Extent of Daily PM_{10} Exceedances

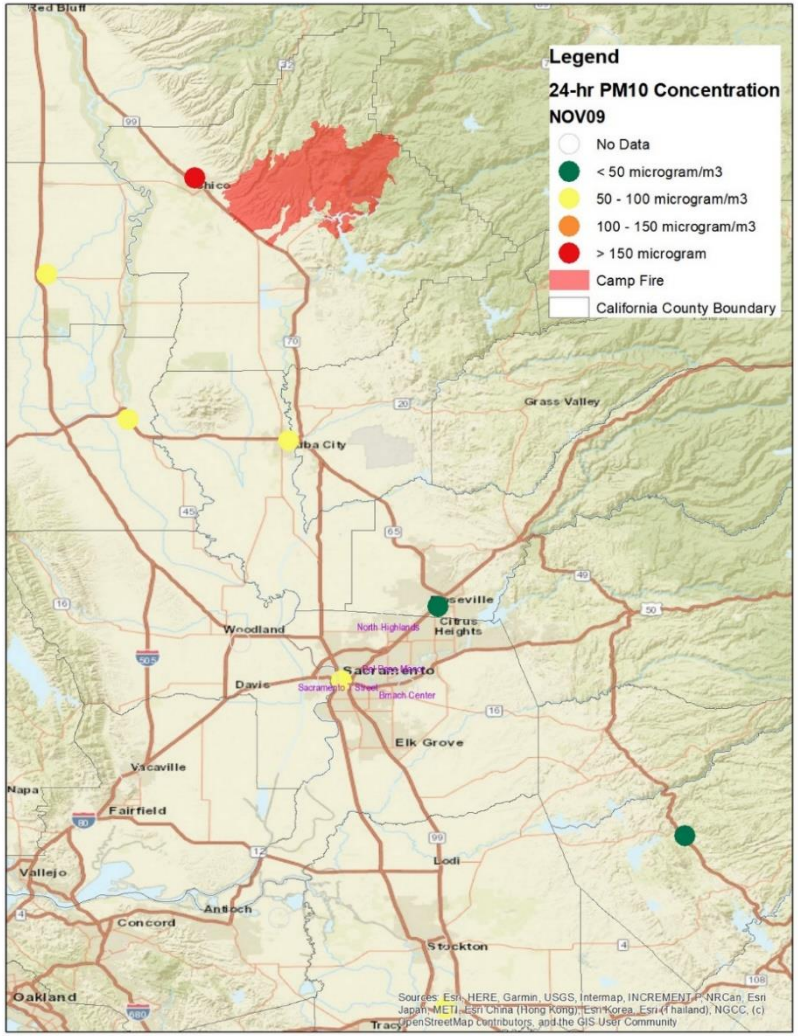
Appendix B shows the daily geographic extent of PM_{10} concentrations from November 7 to November 25, 2018 from the smoke impacts in areas that are located north, south, east and west of Sacramento. These figures show that on 11/7/2018, the day before the Camp Fire Wildfire started, the PM_{10} concentrations were below 50 µg/m^3 in Sacramento and the surrounding communities. Once the fire ignited on 11/8/2018, air quality concentrations were higher than normal in Sacramento County and throughout the region. On 11/10/2018, concentrations in Sacramento County and nearby surrounding counties exceeded the PM_{10} standard. After the last exceedance was recorded in Sacramento County on 11/16/2018, PM_{10} concentrations gradually started to go down until 11/21/2018 when they were back down to either below or just above 50 µg/m^3 in Sacramento and nearby surrounding counties.



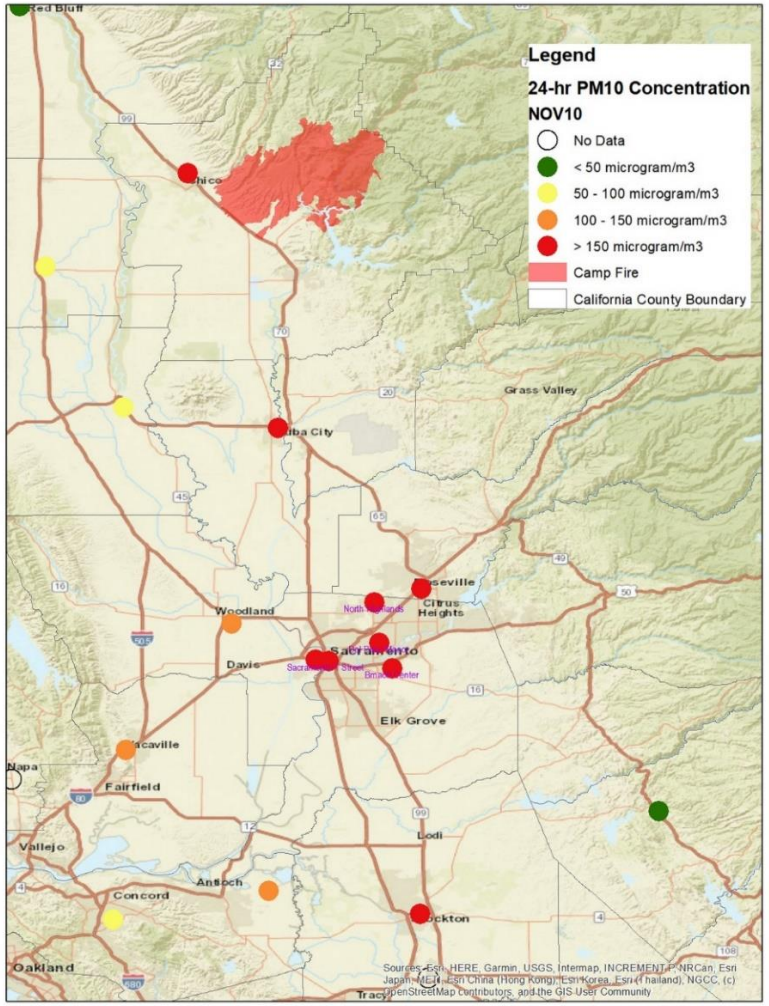
November 07, 2018



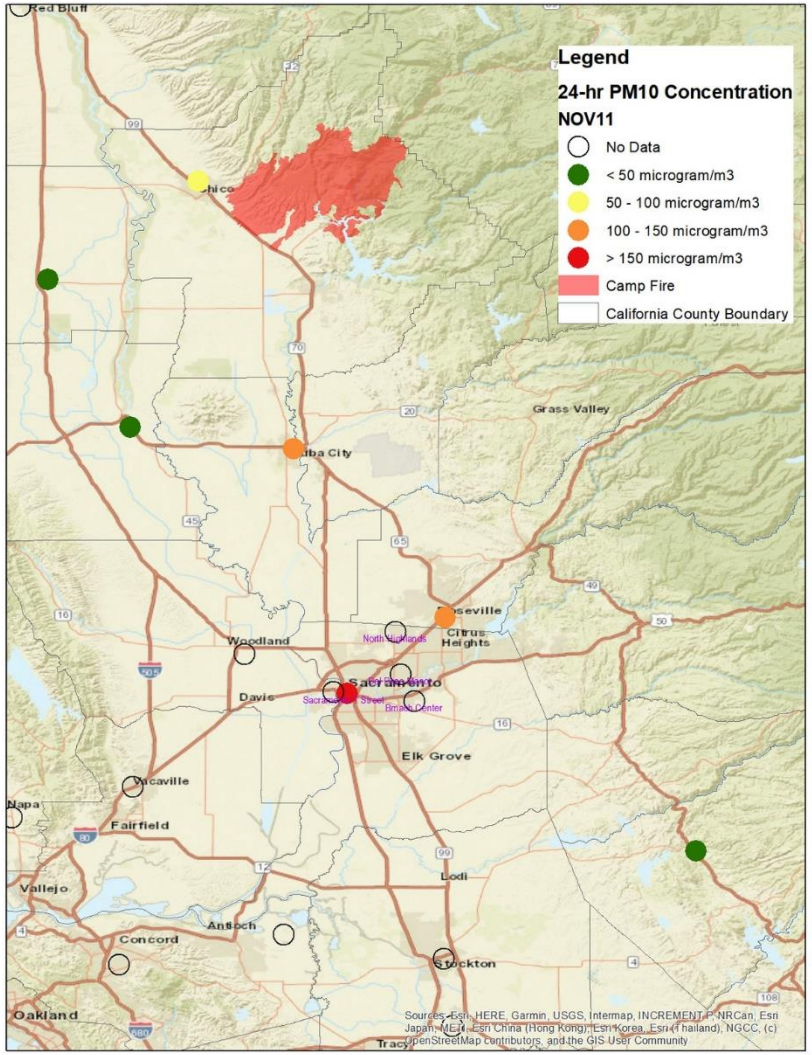
November 08, 2018



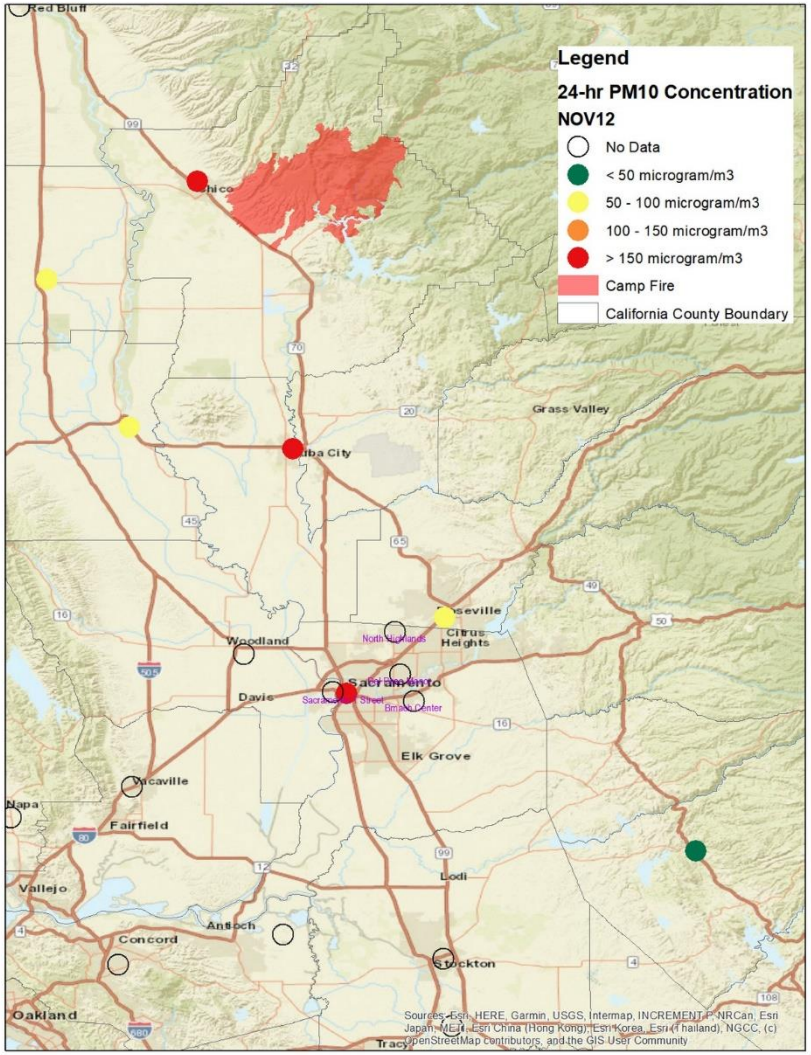
November 09, 2018



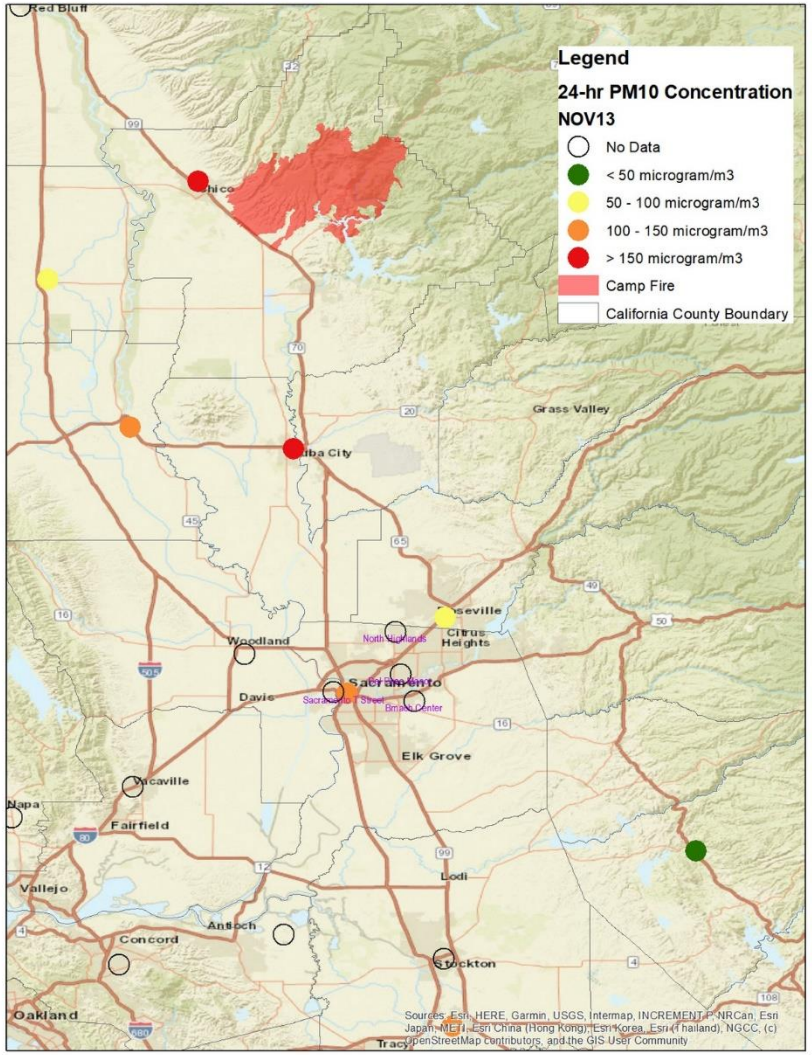
November 10, 2018



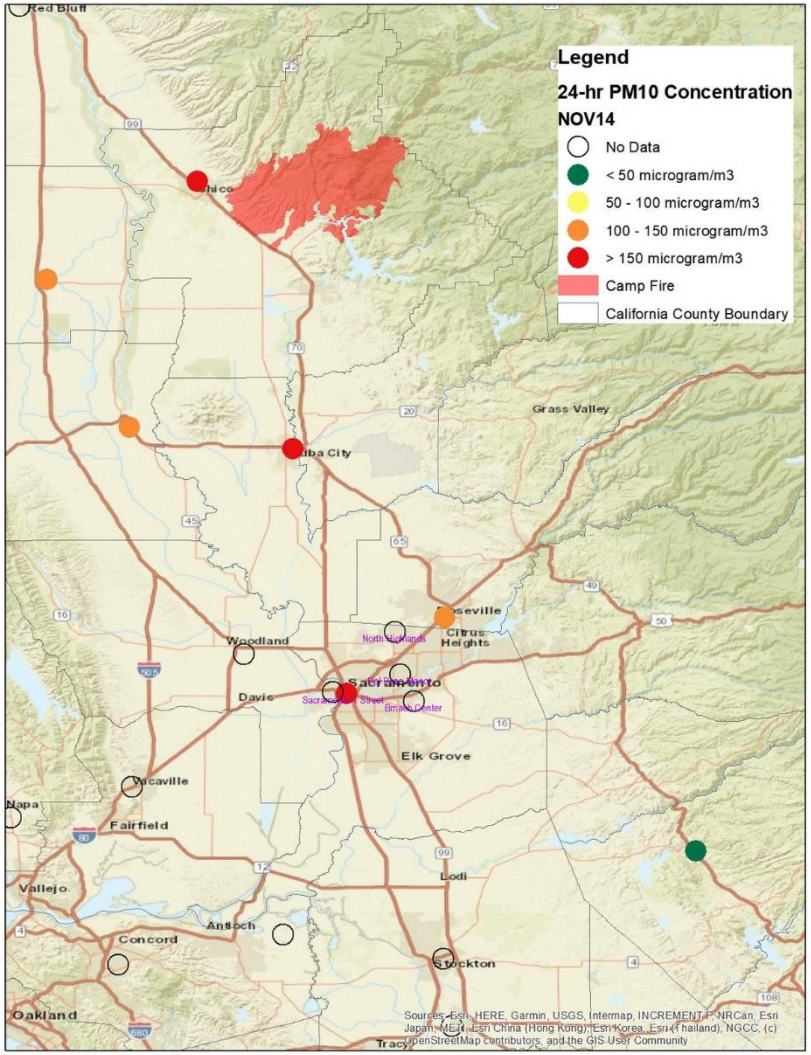
November 11, 2018



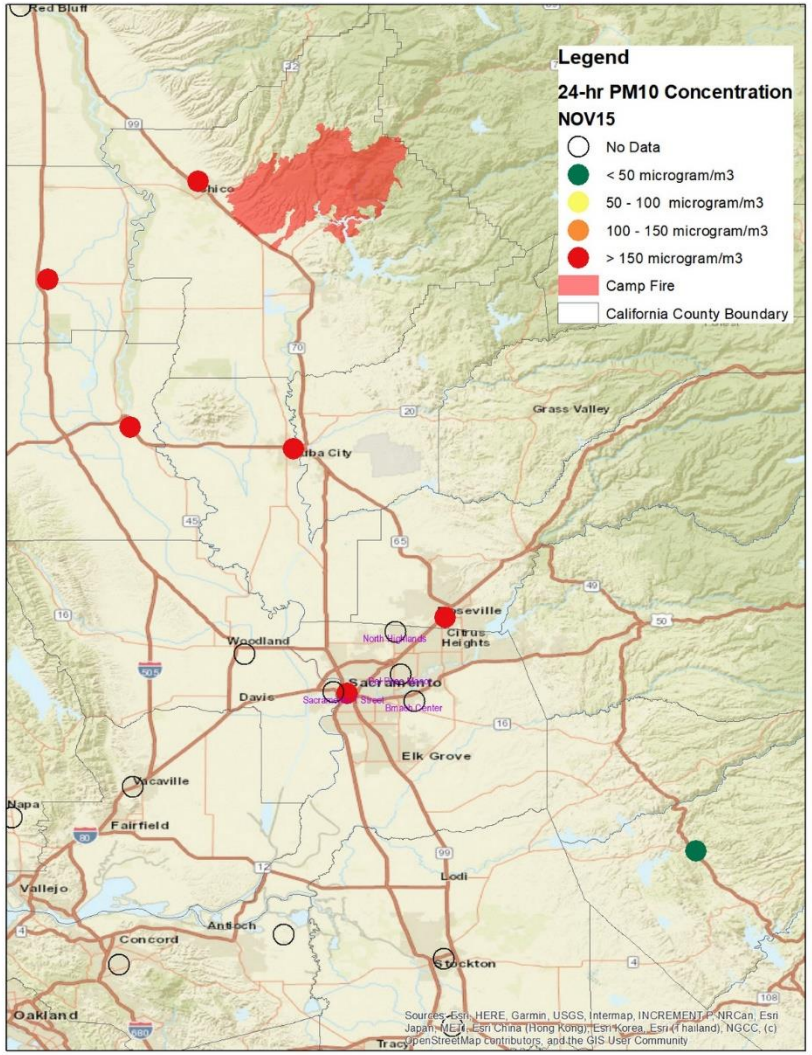
November 12, 2018



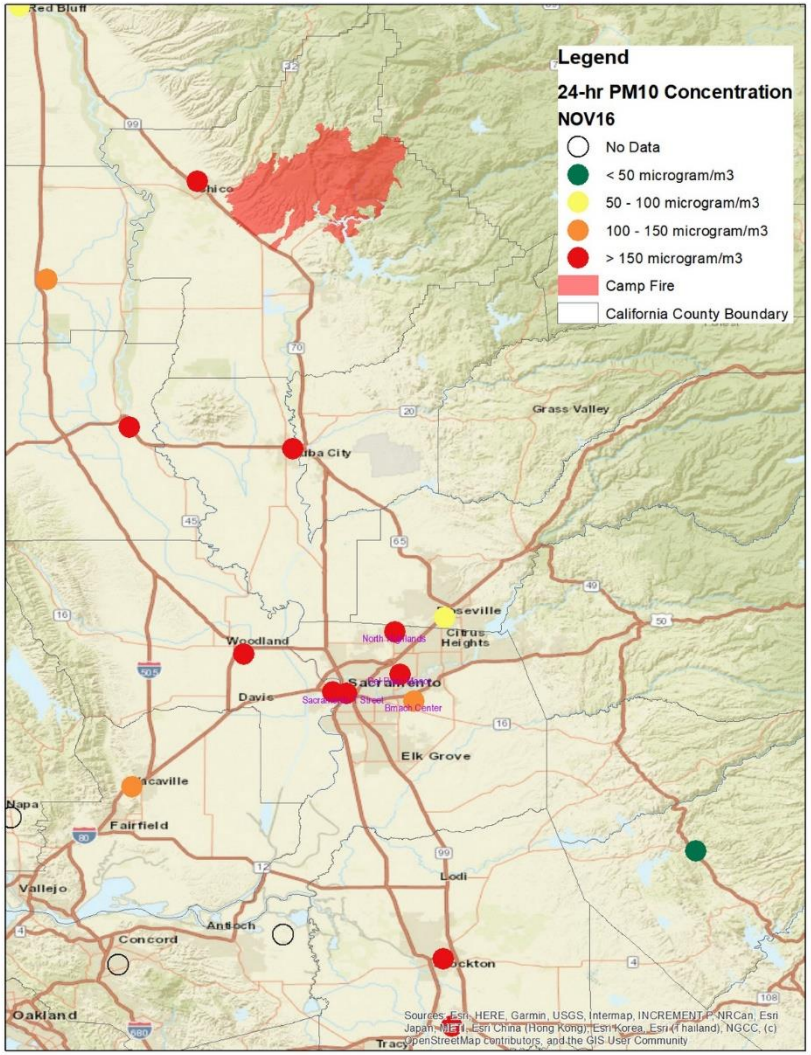
November 13, 2018



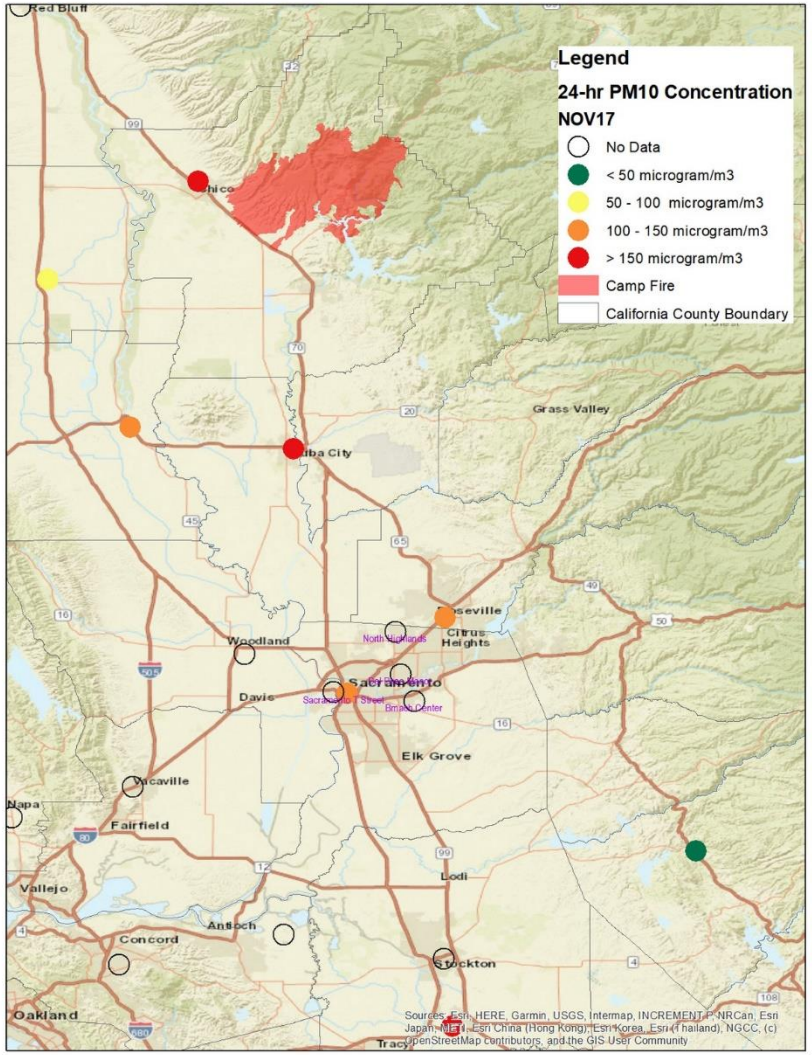
November 14, 2018



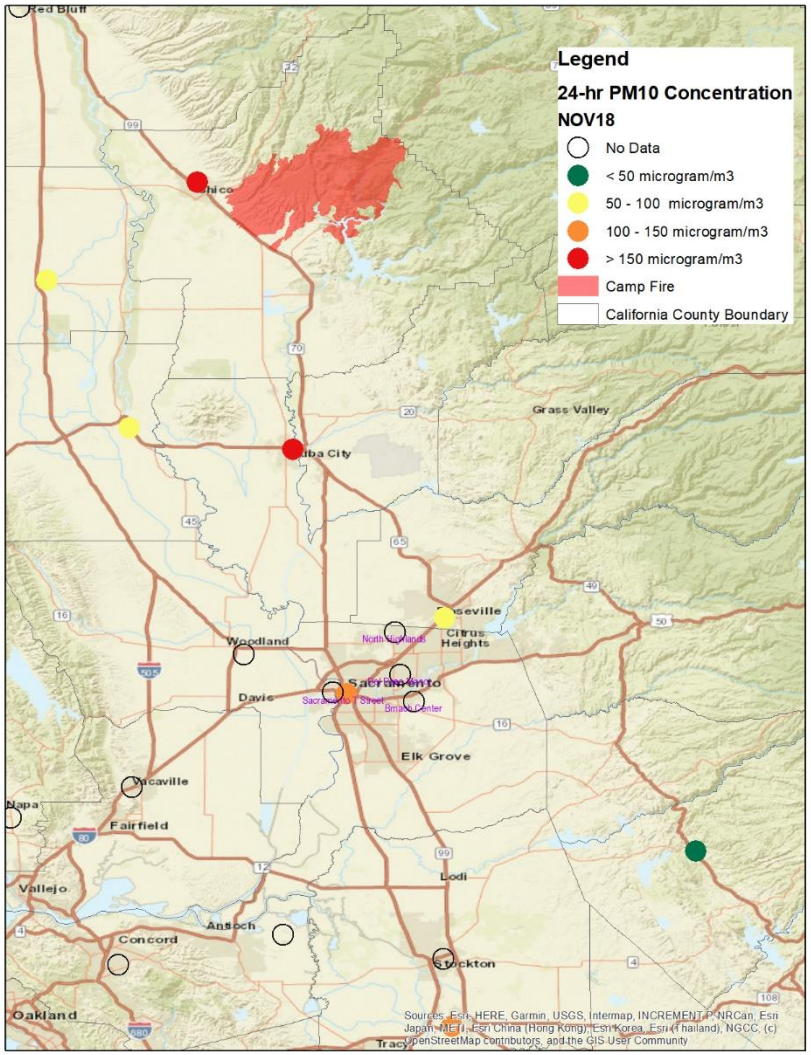
November 15, 2018



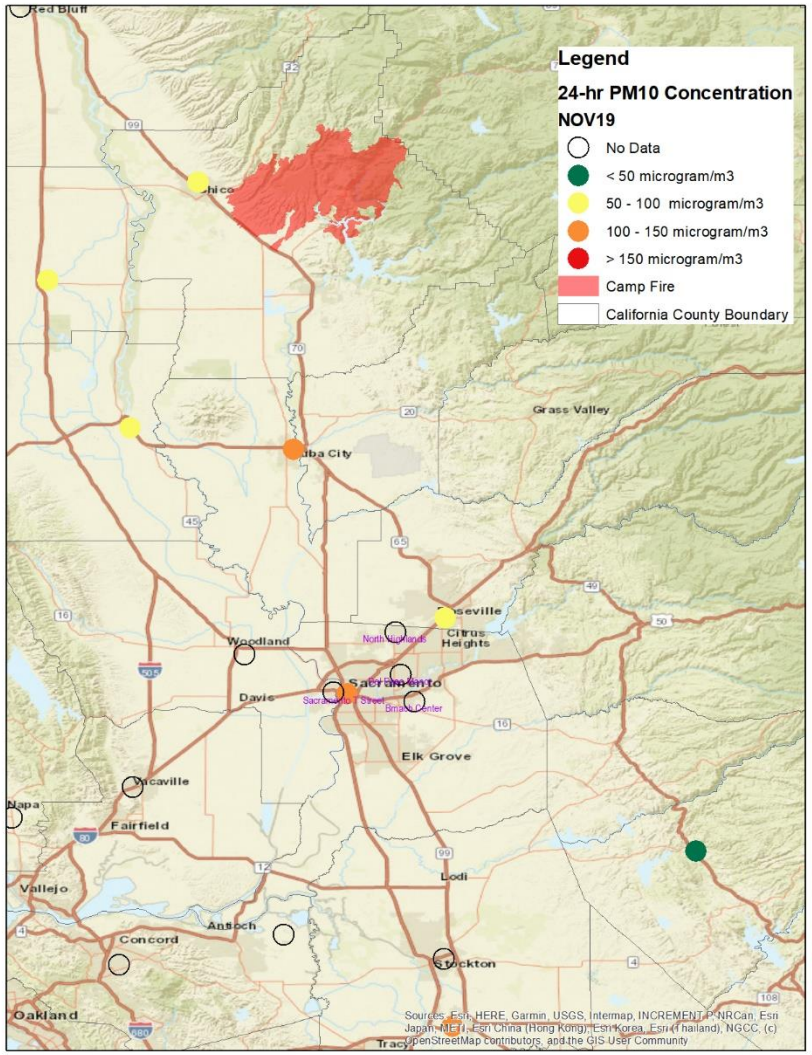
November 16, 2018



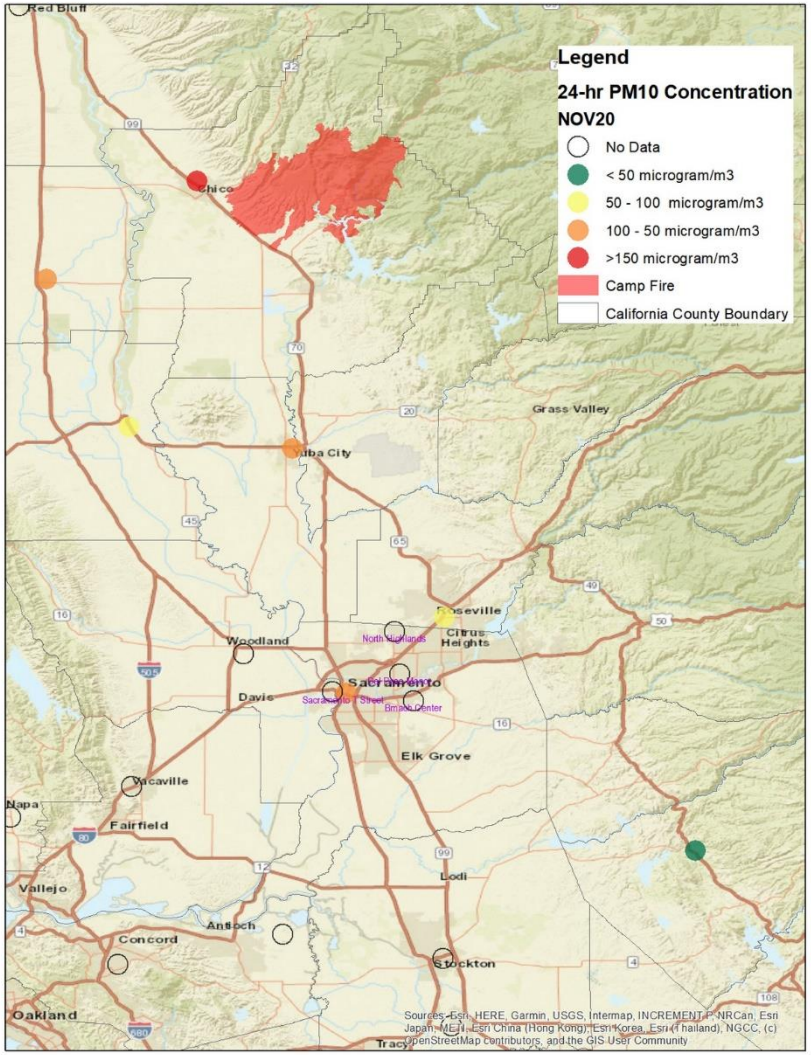
November 17, 2018



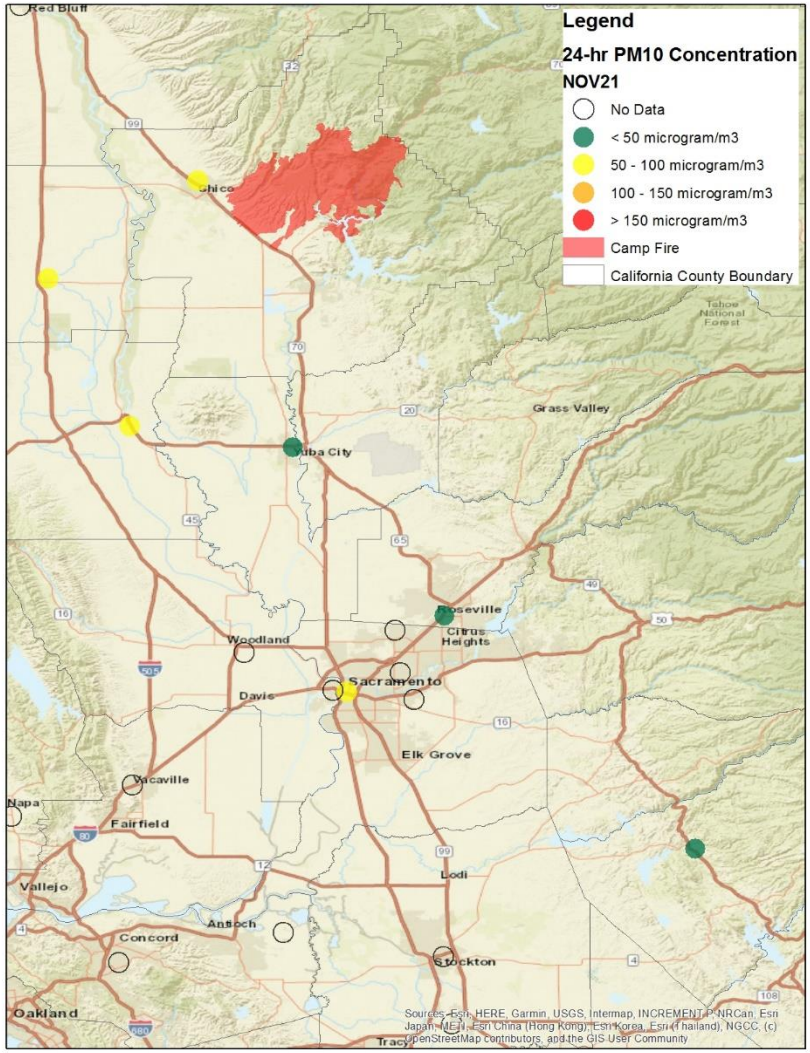
November 18, 2018



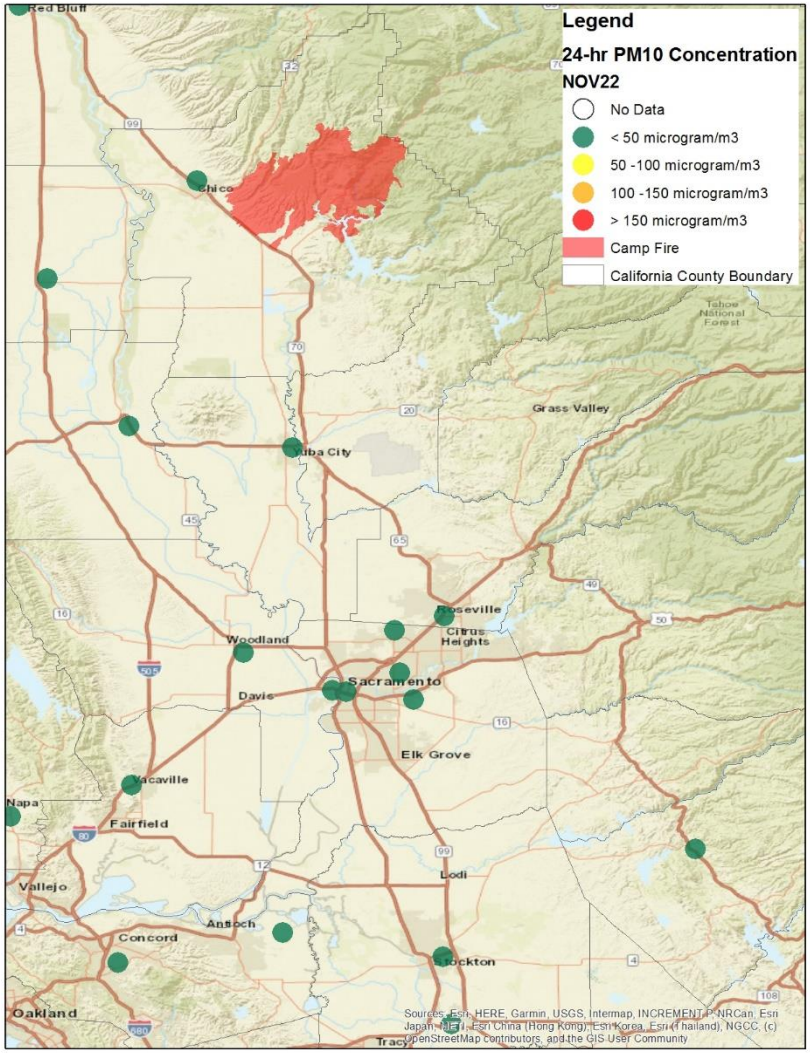
November 19, 2018



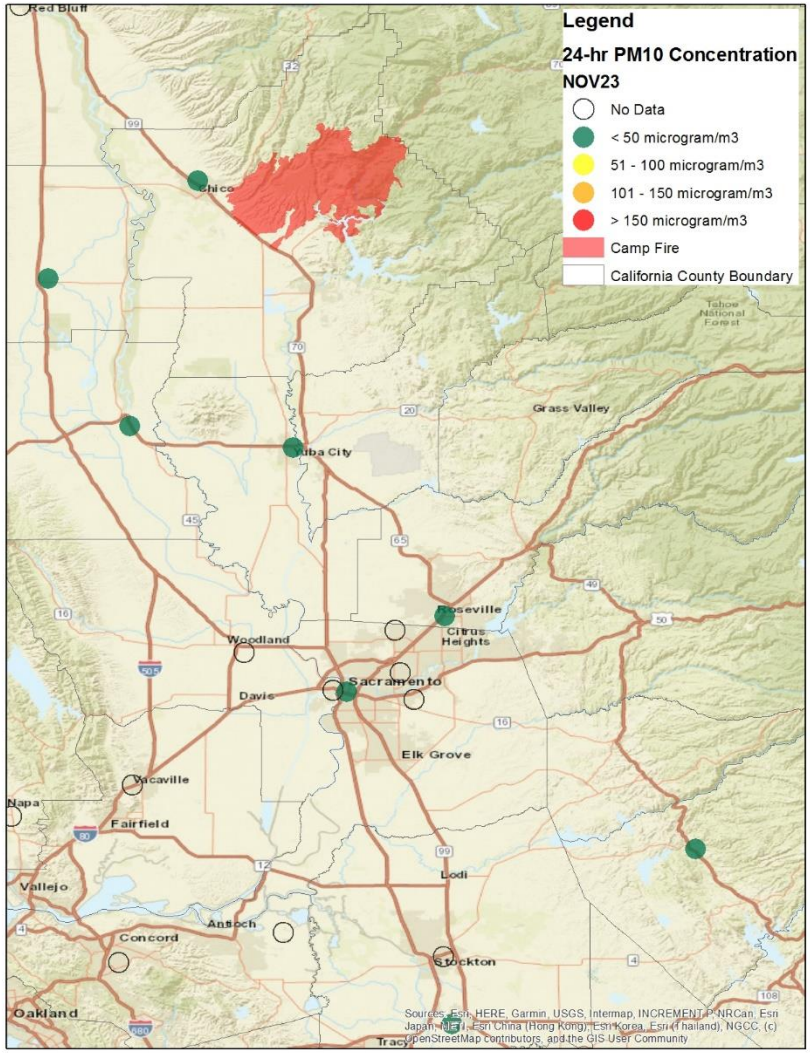
November 20, 2018



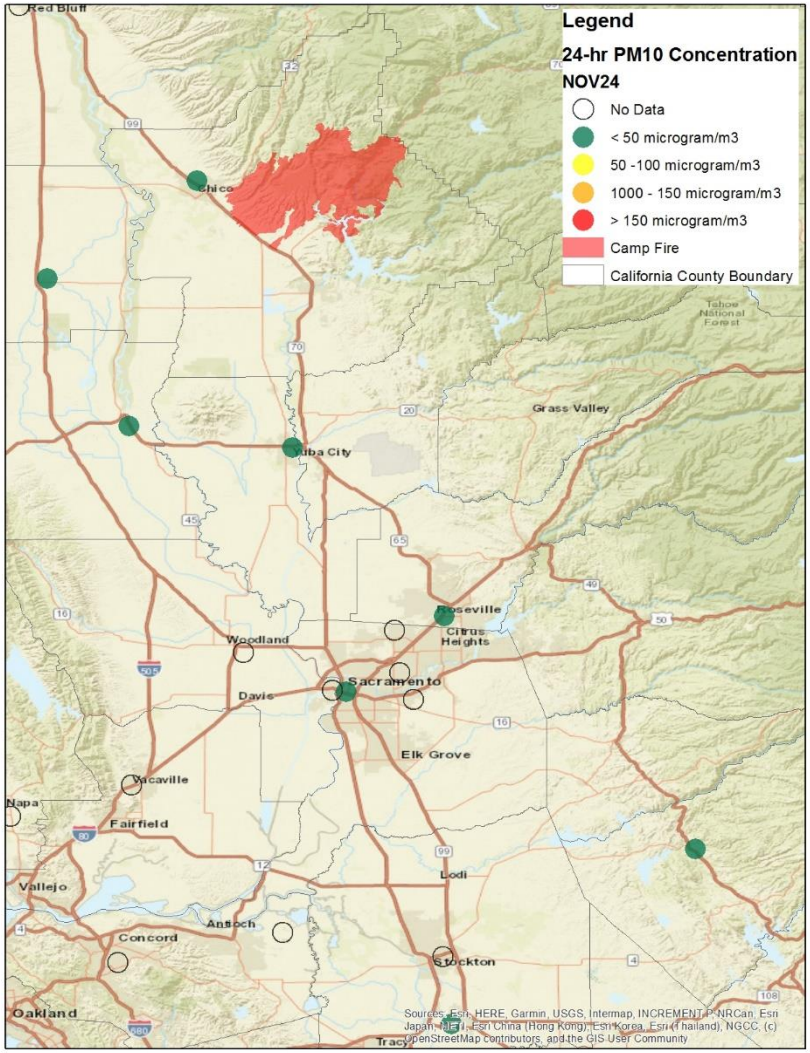
November 21, 2018



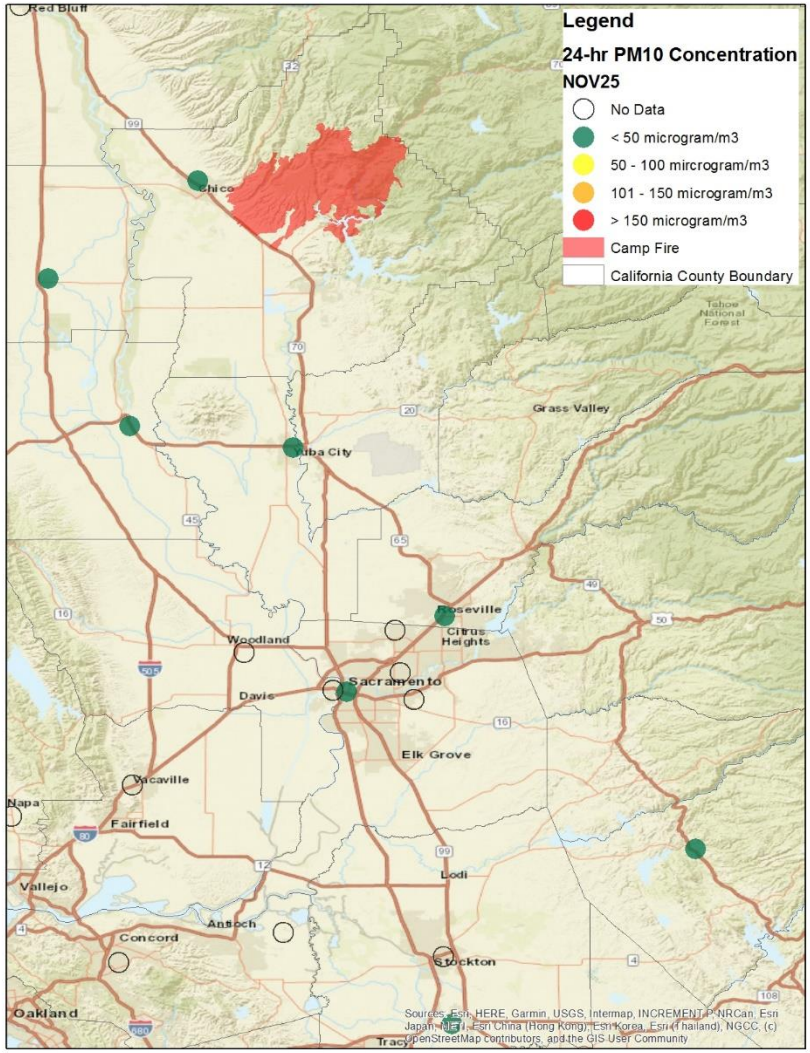
Novmber 22, 2018



November 23, 2018



November 24, 2018

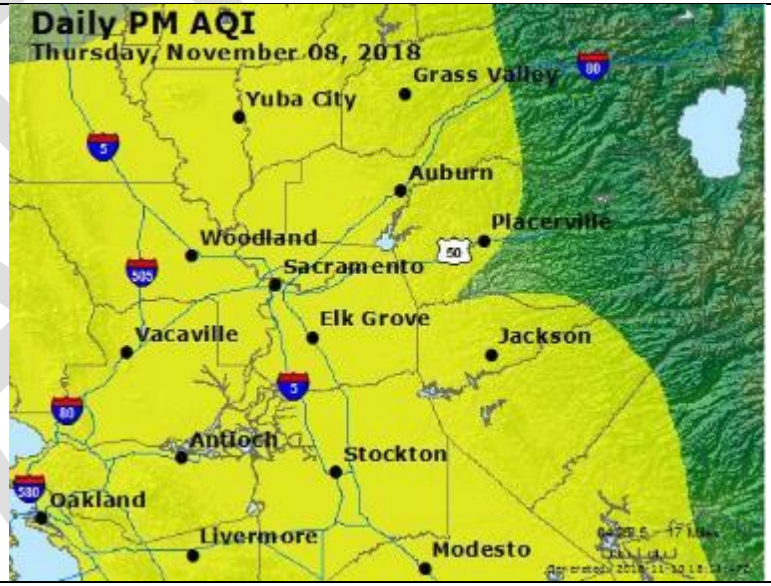


November 25, 2018

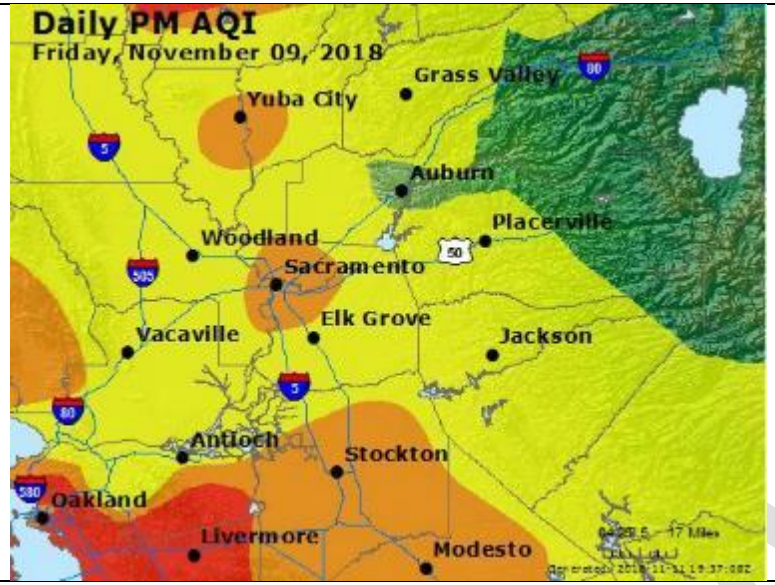
Appendix C Daily Particulate Matter Air Quality Index Levels

The air quality in the Sacramento Valley reached Unhealthy or Very Unhealthy levels during the Camp wildfires (11/10/2018-11/16/2018). The Daily Particulate Matter (includes both $PM_{2.5}$ and PM_{10}) Air Quality Index (AQI) level maps reflect that AQI levels improved (to the moderate or good category) as the smoke from the fire dissipated and the fire neared 100% containment. The AQI levels were also in the moderate category prior to the fire igniting on November 8, 2018 and got worse as fire spread and heavy smoke became prevalent throughout the region. Maps are shown below for November 7 – 25 and the AQI Color Code and levels are shown after the last map.

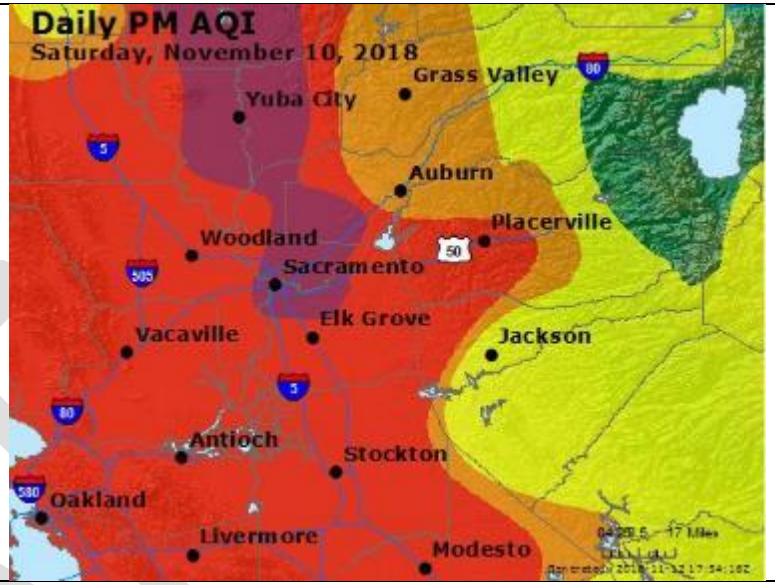
November 07, 2018



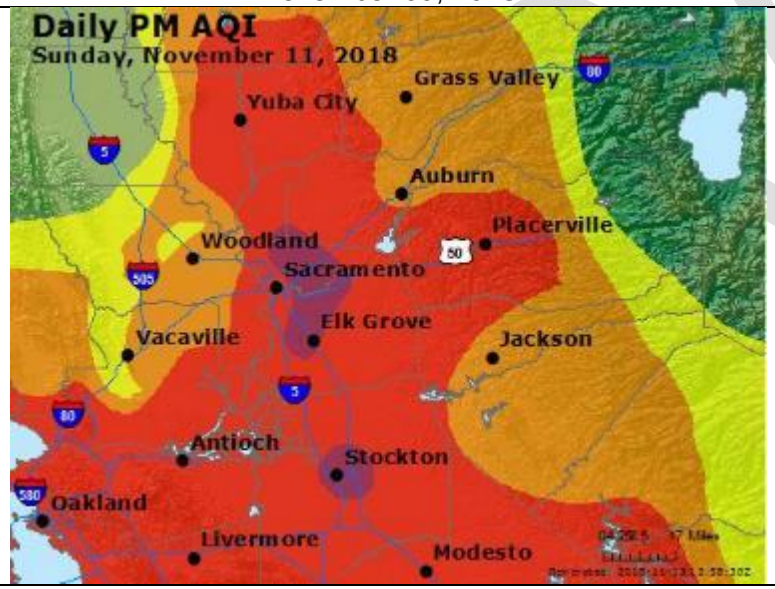
November 08, 2018



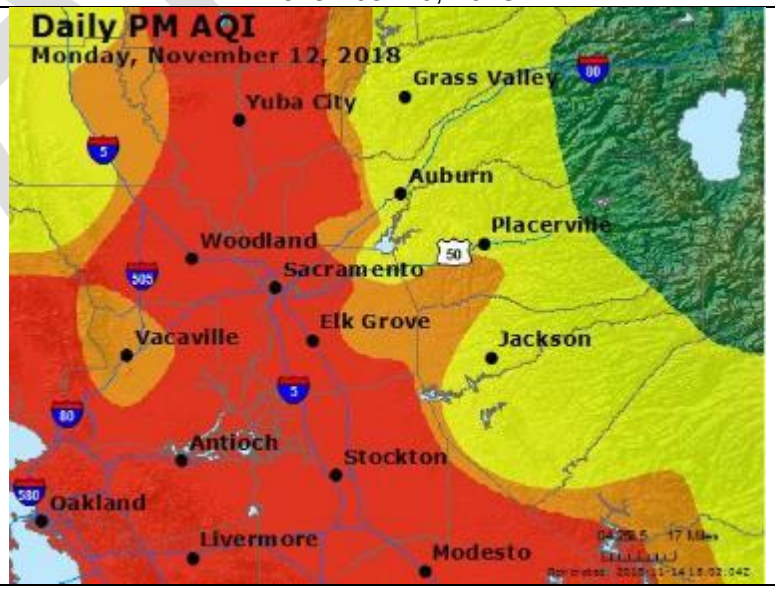
November 09, 2018



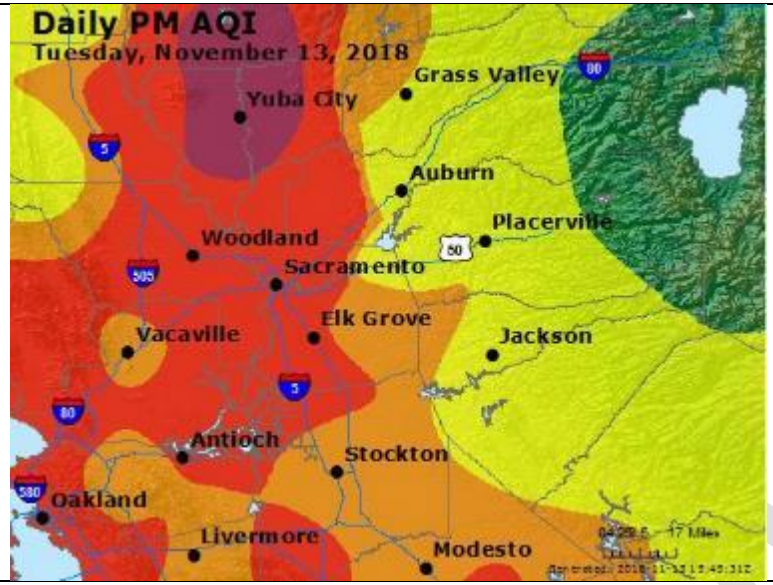
November 10, 2018



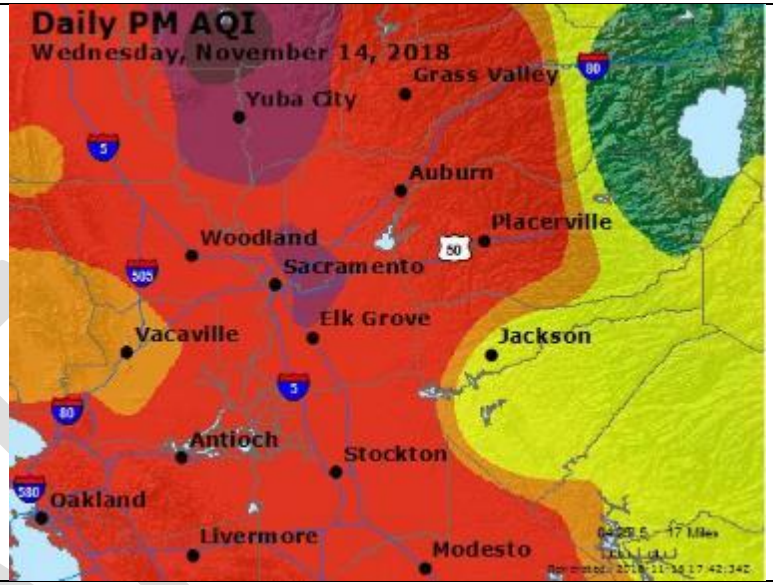
November 11, 2018



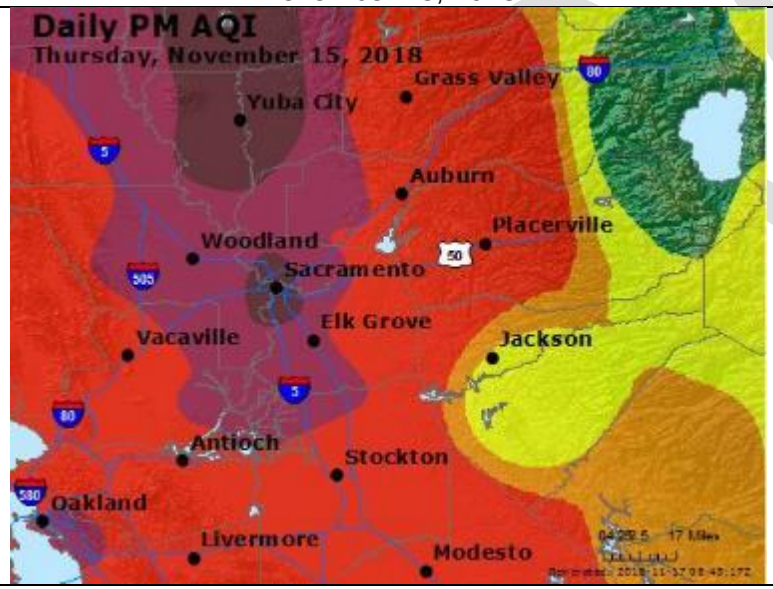
November 12, 2018



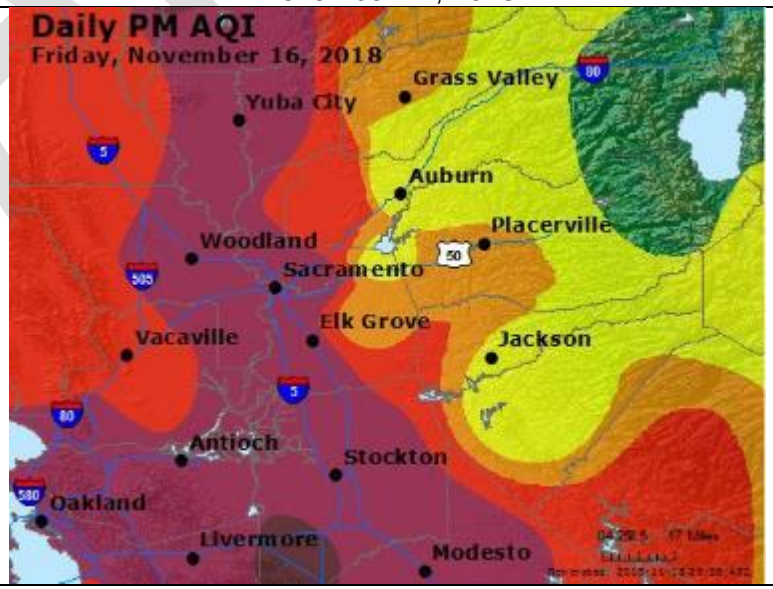
November 13, 2018



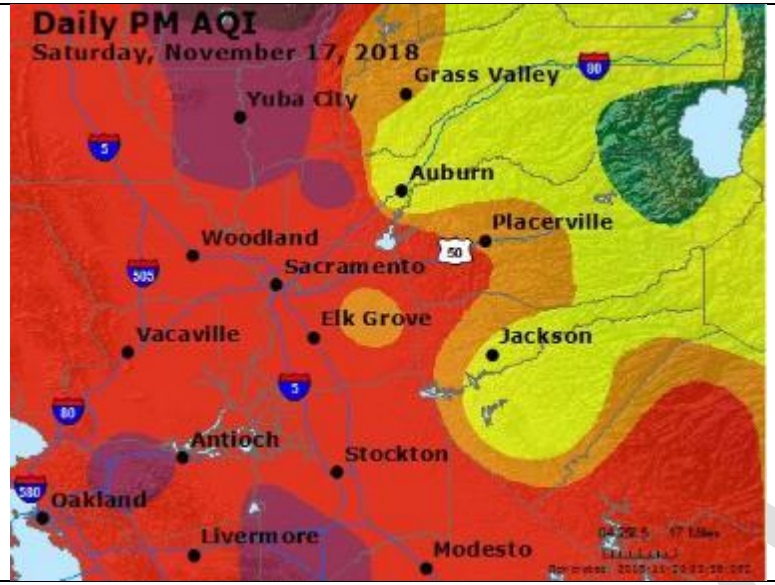
November 14, 2018



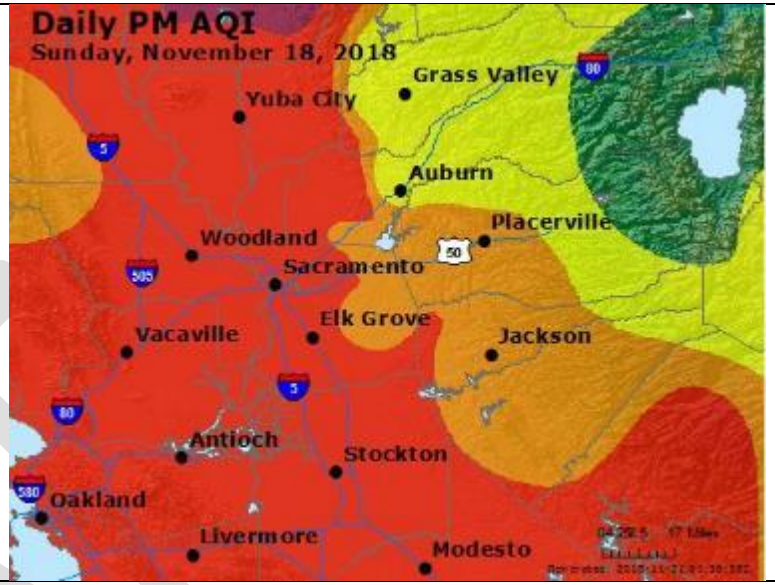
November 15, 2018



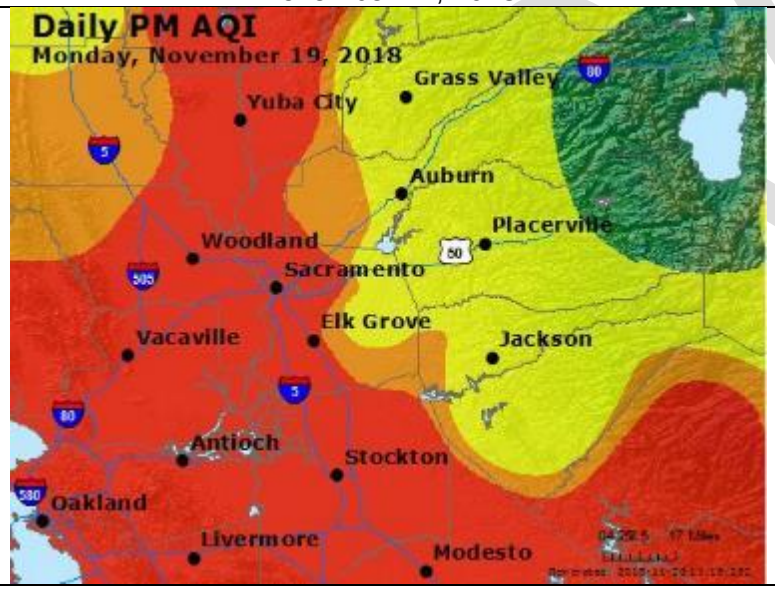
November 16, 2018



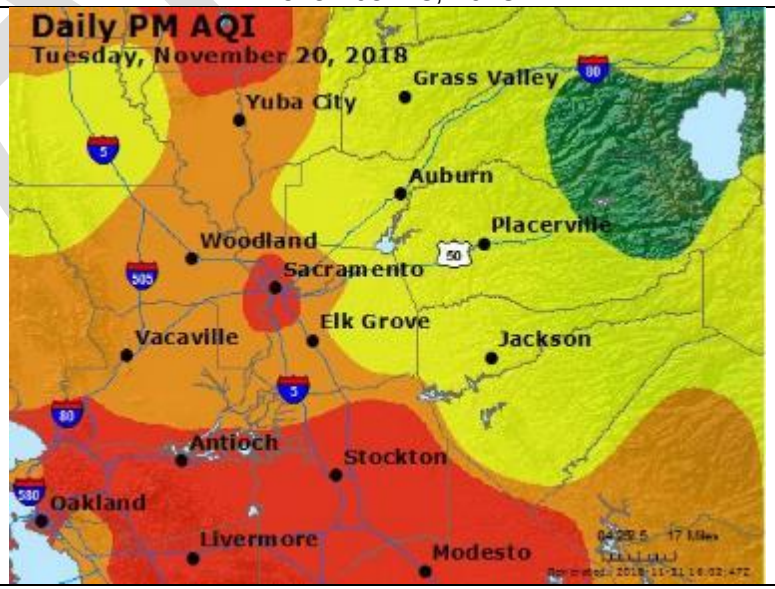
November 17, 2018



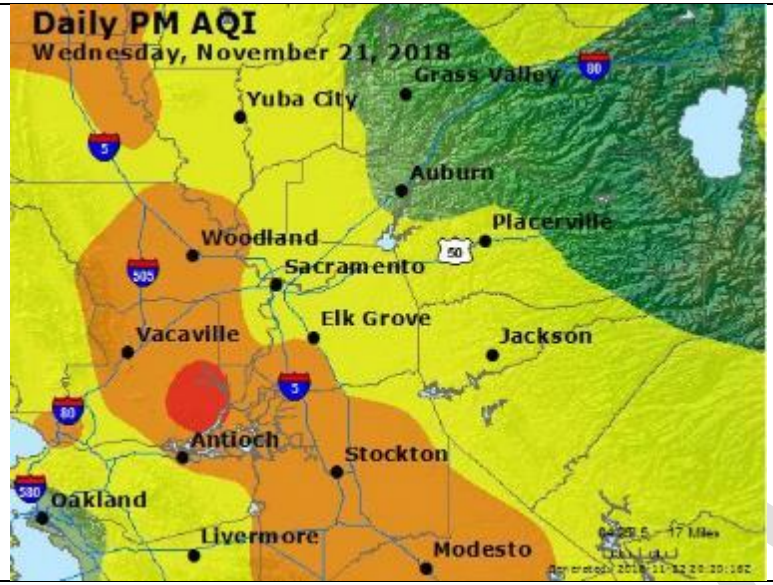
November 18, 2018



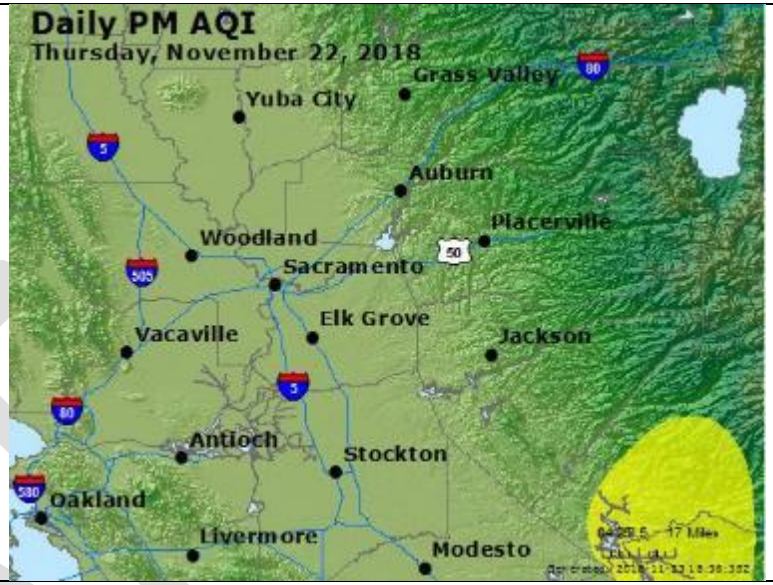
November 19, 2018



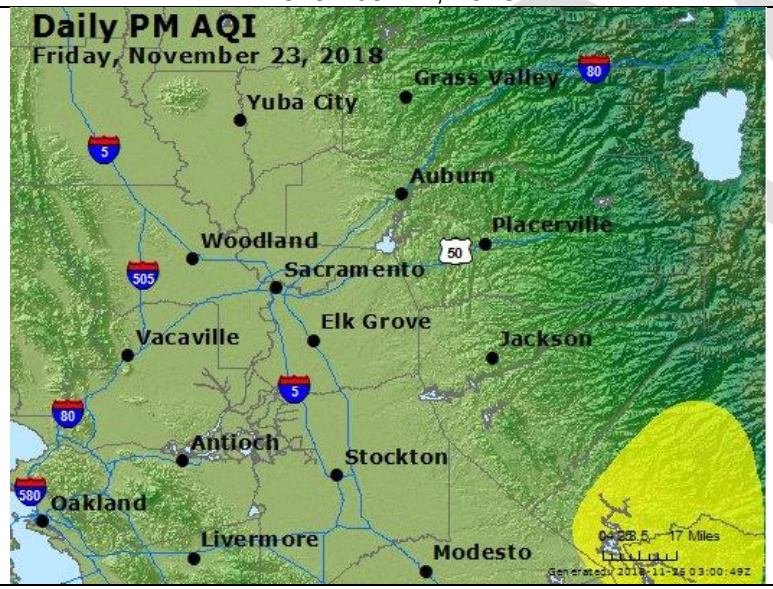
November 20, 2018



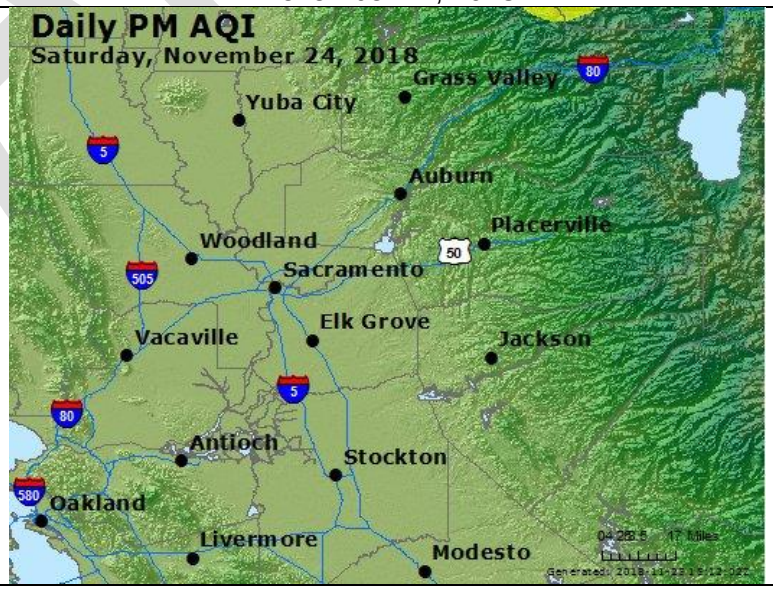
November 21, 2018



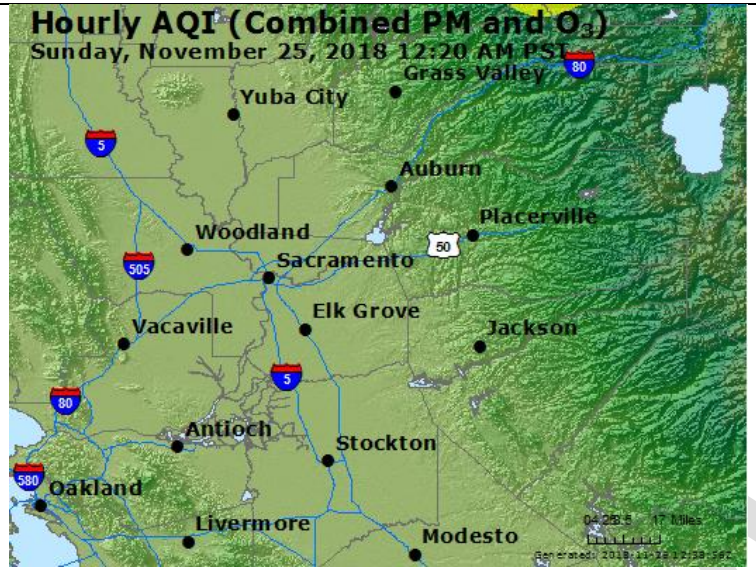
November 22, 2018



November 23, 2018



November 24, 2018



November 25, 2018

AQI Color Code	PM_{10} [24-Hour] AQI
Good	0-50
Moderate	51-100
USG	101-150
Unhealthy	151-200
Very Unhealthy	201-300
Hazardous	301-500

Sources:
USEPA. "*AIR Now Archive*" Web. 8 July 2020 < https://cfpub.epa.gov/airnow/index.cfm?action=airnow.mapsarchivecalendar >

Appendix D Air Quality Advisories

November 9, 2018

Contact: Sac Metro Air District Communications Office (916) 874-4888
Sacramento County Public Health (916) 874-7798

Wildfire Smoke Statement

Sacramento, CA – The Sacramento Metropolitan Air Quality Management District, in conjunction with Sacramento County Public Health, is advising residents to take precautions and minimize outdoor activities if they see or smell smoke transported by the Camp Fire in Butte County.

Smoke from this fire most likely will affect Sacramento through Wednesday, November 14 but may last longer depending on the strength and direction of the winds and the fire status. Due to the unpredictable nature of wildfire smoke, particulate matter (PM) pollution levels can be elevated in one area, but not another.

Wildfire smoke is harmful to your health. If you see or smell smoke, take the following actions:

- Minimize outdoor activities if you see or smell smoke, even if you're healthy
- Children, the elderly and people with respiratory or heart conditions should be particularly careful to avoid exposure
- Stay indoors with doors and windows closed as much as possible
- Asthmatics should follow their asthma management plan
- Contact your doctor if you have symptoms of cough, shortness of breath, or other symptoms you believe to be caused by smoke
- Those with heart disease should especially limit their smoke exposure since PM can cause heart attacks

For more information, visit the Sac Metro Air District's wildfire page at http://www.airquality.org/Air-Quality-Health/Climate-Change/Public-Outreach/Wildfire-Smoke-Information

You may also download the free Sacramento Region Air Quality app or sign up for Air Alert emails at www.SpareTheAir.com.

###

November 14, 2018

Contact: Sac Metro Air District Communications Office (916) 874-4888
Sacramento County Public Health (916) 874-7798

Wildfire Smoke Statement

Sacramento, CA – The Sacramento Metropolitan Air Quality Management District, in conjunction with Sacramento County Public Health, is advising residents to take precautions and minimize outdoor activities through Friday, November 16 due to smoke from the Camp Fire that continues to impact the county's air quality.

Due to the unpredictable nature of wildfire smoke, particulate matter (PM) pollution levels can be elevated in one area, but not another.

Wildfire smoke is harmful to your health. If you see or smell smoke, take the following actions:

- Minimize outdoor activities if you see or smell smoke, even if you're healthy
- Children, the elderly and people with respiratory or heart conditions should be particularly careful to avoid exposure
- Stay indoors with doors and windows closed as much as possible
- Asthmatics should follow their asthma management plan
- Contact your doctor if you have symptoms of cough, shortness of breath, or other symptoms you believe to be caused by smoke
- Those with heart disease should especially limit their smoke exposure since PM can cause heart attacks

For more information, visit the Sac Metro Air District's wildfire page at http://www.airquality.org/Air-Quality-Health/Climate-Change/Public-Outreach/Wildfire-Smoke-Information

You may also download the free Sacramento Region Air Quality app or sign up for Air Alert emails at www.SpareTheAir.com.

###

November 16, 2018

Contact: Sac Metro Air District Communications Office (916) 874-4888
Sacramento County Public Health (916) 874-7798

Wildfire Smoke Advisory Continues Through Monday, November 19

Sacramento, CA – The Sacramento Metropolitan Air Quality Management District, in conjunction with Sacramento County Public Health, continues to advise residents to take precautions, stay indoors with doors and windows closed, and minimize outdoor activities through Monday, November 19 due to smoke from the Camp Fire.

Due to the unpredictable nature of wildfire smoke, particulate matter (PM) pollution levels can be elevated in one area, but not another so check Current Conditions at www.SpareTheAir.com/aqirealtime.cfm before making any outdoor plans.

Wildfire smoke is harmful to your health. If you see or smell smoke, take the following actions:

- Stay indoors with doors and windows closed as much as possible
- Minimize outdoor activities if you see or smell smoke, even if you're healthy
- Children, the elderly and people with respiratory or heart conditions should be particularly careful to avoid exposure
- Asthmatics should follow their asthma management plan
- Contact your doctor if you have symptoms of cough, shortness of breath, or other symptoms you believe to be caused by smoke
- Those with heart disease should especially limit their smoke exposure since PM can cause heart attacks

For more information, visit the Sac Metro Air District's wildfire page at http://www.airquality.org/Air-Quality-Health/Climate-Change/Public-Outreach/Wildfire-Smoke-Information

You may also download the free Sacramento Region Air Quality app or sign up for Air Alert emails at www.SpareTheAir.com.

###