Documentation of Recent Wildfire Exceptional Events in the San Joaquin Valley

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WESTAR Exceptional Events Workshop

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Topics

- Successes and Challenges
- Essential Elements and Practices
- Transport and Multiple Wildfire Events
- Best Practices and Lessons Learned

Background: Ongoing Wildfire Challenges

- Emissions from wildfires are enormous, can well exceed total mobile and industrial source emissions in the Valley
  - Wildfire emissions easily overwhelm all control measures
  - Leads to excessively high PM and ozone concentrations
- Decades-long fire suppression policies and excessive fuel build-up, widespread drought-driven tree mortality, changing climate conditions (higher temperatures and drier conditions) causing intense wildfire seasons in Western U.S. in recent years

Top 20 Largest California Wildfires

- 9 of top 20 largest wildfires in California history have occurred during 2020/2021 wildfire seasons
- Evidence of increasingly intense and destructive fire activity

Top 20 Largest California Wildfires

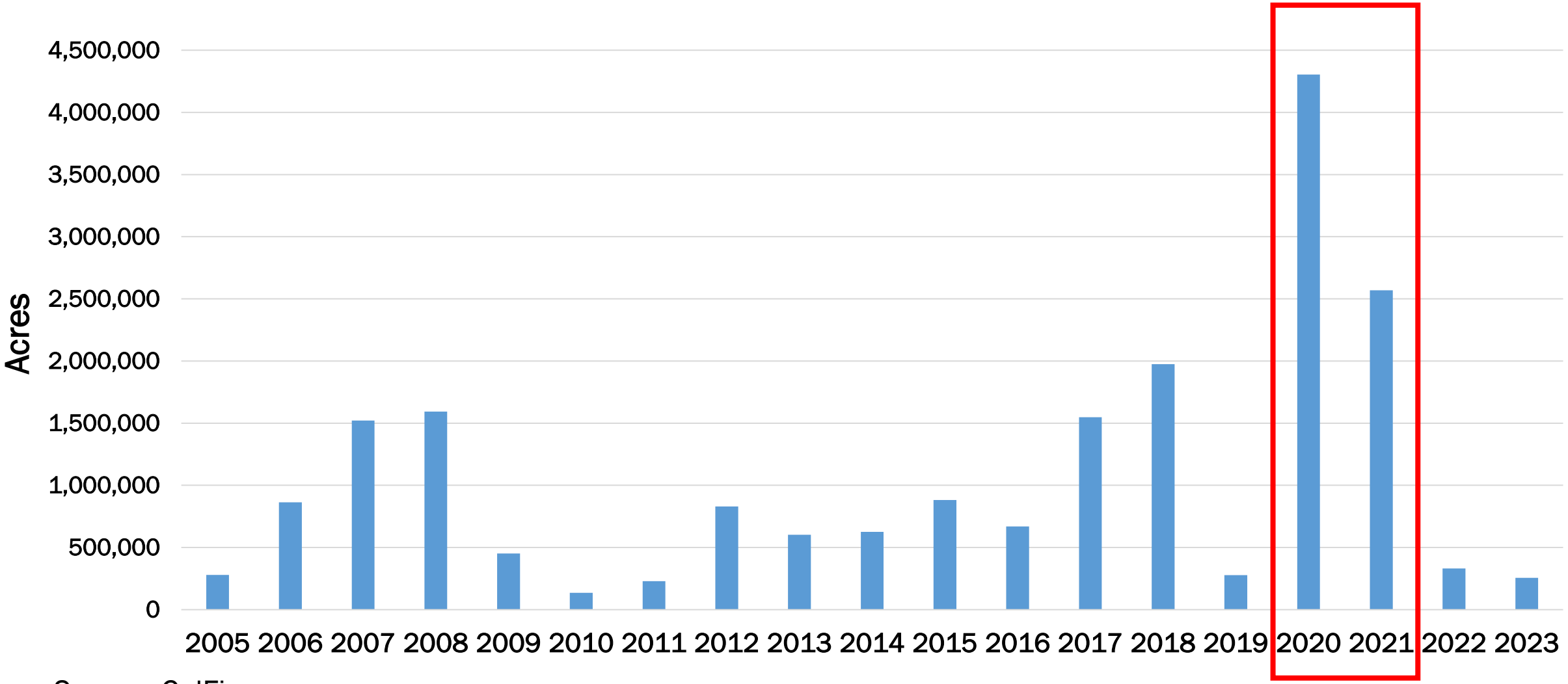
	FIRE NAME (CAUSE)	DATE	COUNTY	ACRES	STRUCTURES	DEATHS
1	**AUGUST COMPLEX** *(Lightning)*	August 2020	Mendocino, Humboldt, Trinity, Tehama, Glenn, Lake, & Colusa	**1,032,648**	935	1
2	**DIXIE** *(Powerlines)*	July 2021	Butte, Plumas, Lassen, Shasta & Tehama	**963,309**	1,311	1
3	**MENDOCINO COMPLEX** *(Human Related)*	July 2018	Colusa, Lake, Mendocino & Glenn	**459,123**	280	1
4	**SCU LIGHTNING COMPLEX** *(Lightning)*	August 2020	Stanislaus, Santa Clara, Alameda, Contra Costa, & San Joaquin	**396,625**	225	0
5	**CREEK** *(Undetermined)*	September 2020	Fresno & Madera	**379,895**	858	0
6	**LNU LIGHTNING COMPLEX** *(Lightning/Arson)*	August 2020	Napa, Solano, Sonoma, Yolo, Lake, & Colusa	**363,220**	1,491	6
7	**NORTH COMPLEX** *(Lightning)*	August 2020	Butte, Plumas & Yuba	**318,935**	2,352	15
8	**THOMAS** *(Powerlines)*	December 2017	Ventura & Santa Barbara	**281,893**	1,060	2
9	**CEDAR** *(Human Related)*	October 2003	San Diego	**273,246**	2,820	15
10	**RUSH** *(Lightning)*	August 2012	Lassen	**271,911 CA / 43,666 NV**	0	0
11	**RIM** *(Human Related)*	August 2013	Tuolumne	**257,314**	112	0
12	**ZACA** *(Human Related)*	July 2007	Santa Barbara	**240,207**	1	0
13	**CARR** *(Human Related)*	July 2018	Shasta County & Trinity	**229,651**	1,614	8
14	**MONUMENT** *(Lightning)*	July 2021	Trinity	**223,124**	28	0
15	**CALDOR** *(Human Releated)*	August 2021	Alpine, Amador, & El Dorado	**221,835**	1,005	1
16	**MATILIJA** *(Undetermined)*	September 1932	Ventura	**220,000**	0	0
17	**RIVER COMPLEX** *(Lightning)*	July 2021	Siskiyou & Trinity	**199,359**	122	0
18	**WITCH** *(Powerlines)*	October 2007	San Diego	**197,990**	1,650	2
19	**KLAMATH THEATER COMPLEX** *(Lightning)*	June 2008	Siskiyou	**192,038**	0	2
20	**MARBLE CONE** *(Lightning)*	July 1977	Monterey	**177,866**	0	0

There is no doubt that there were fires with significant acreage burned in years prior to 1932, but those records are less reliable, and this list is meant to give an overview of the large fires in more recent times.
This list does not include fire jurisdiction. These are the Top 20 regardless of whether they were state, federal, or local responsibility.
*Numbers not final.

10/24/2022

Source: CalFire

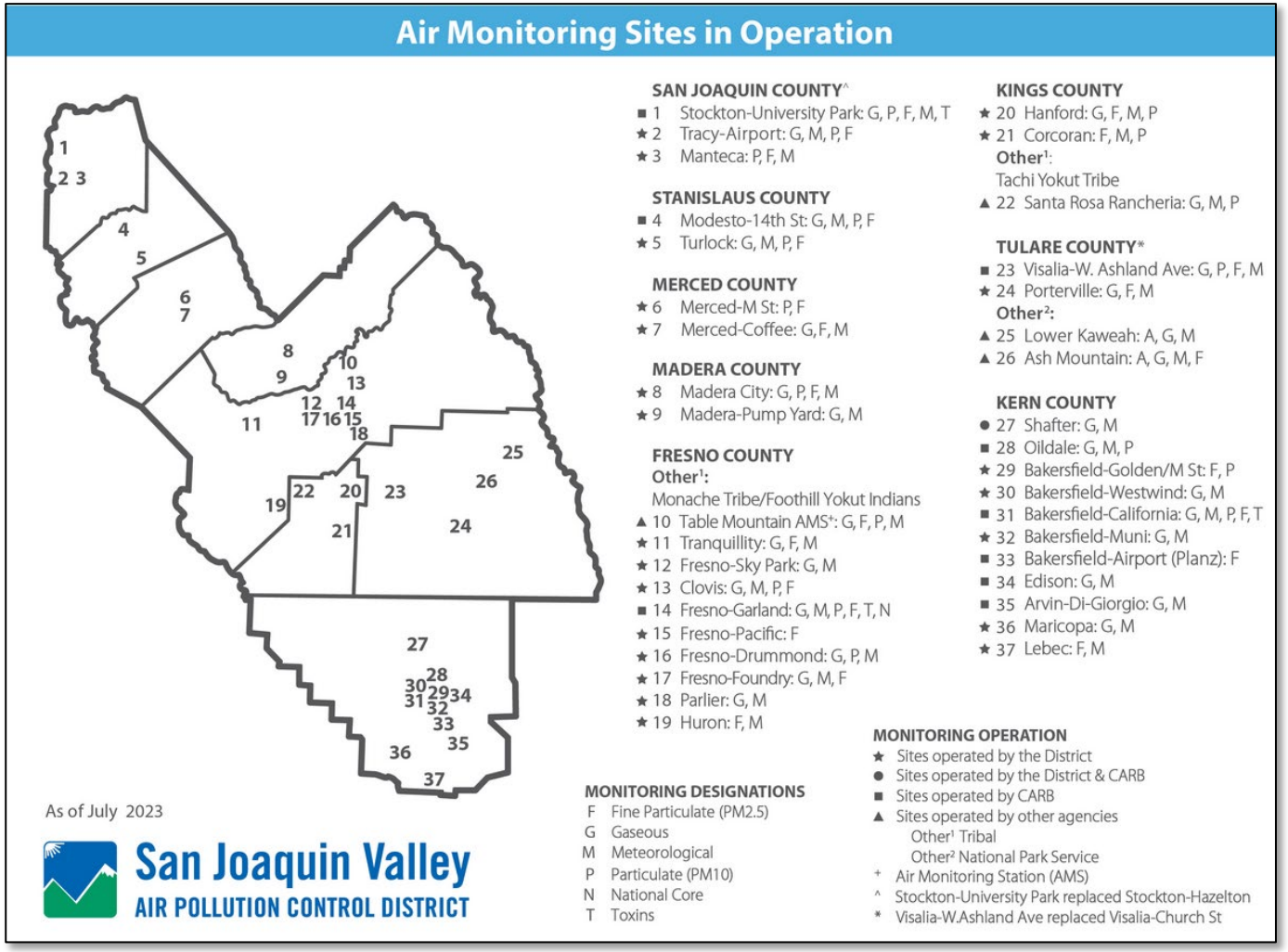
2020/2021 Worst CA Wildfire Seasons on Record



Source: CalFire

San Joaquin Valley - Air Monitoring Network

- Local air pollution control district in central California
- 8 Counties: San Joaquin, Stanislaus, Merced, Madera, Fresno, Kings, Tulare, and Valley air basin portion of Kern counties
- 37 air monitoring stations in the SJV
  - 25 sites with Ozone monitoring
  - 24 sites with PM2.5 monitoring
  - 18 sites with PM10 monitoring



EE Demonstrations in the San Joaquin Valley

Successful Attempts Before the 2016 EE Rule Changes

- PM10 from Windblown Dust
- PM10 form Fireworks

Successes After the 2016 EE Rule Changes

- Wildfires: Attainment of 1997 24-hour PM2.5 (65 µg/m^3)

Attempts and In-Progress Demonstrations

- Wildfires and High-Winds: Maintenance of 24-hour PM10: In-Progress
- Wildfires and Fireworks: 1997 annual PM2.5 (15 µg/m^3): Unsuccessful

Key Elements of Successful Wildfire Demonstration

- Emissions Occurred
  - Gathering evidence of details of the wildfire and that it occurred on wildlands
- Smoke Transport
  - Satellite imagery, surrounding monitoring sites showed regional impacts, trajectory analysis (HYSPLIT)
- Smoke Impacts at the Air Monitoring Site
  - PM2.5 chemical speciation, relationships in correlating pollutants e.g. PM2.5 and CO

Contributions to Successful Wildfire EE Demo.

Data quality and scope of impacts

- PM2.5 data record for the 3-year design value period was high quality and complete
- Relatively few site-day exceedances

Close coordination with State and EPA

- Regular coordination with experienced and dedicated staff at local, state, and federal agencies

Recent Success: 1997 24-hour PM2.5 NAAQS

1997 PM2.5 NAAQS

24-hour and Annual Standards

2018-2020

Non-Attaining Design Values were impacted by smoke from wildfires

24-hour NAAQS

8 sites

5 dates

30 site-days

Recent Success: 1997 24-hour PM2.5 NAAQS

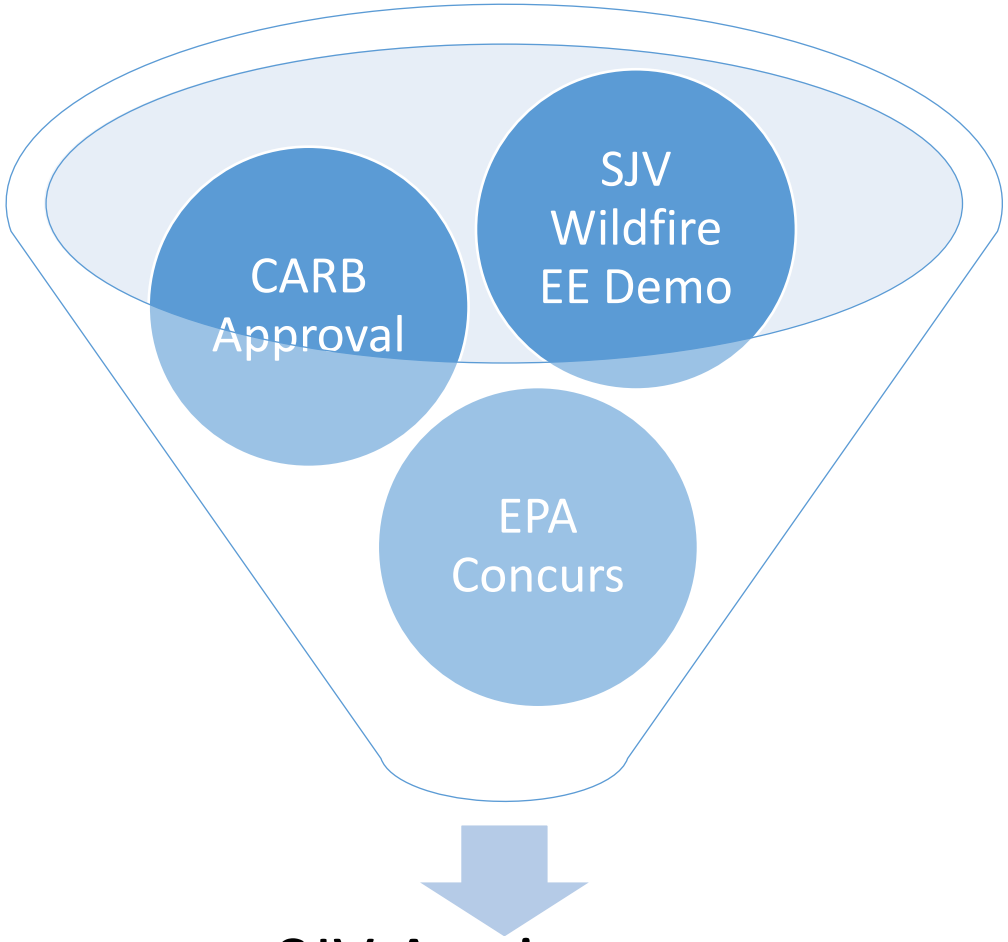
- 30 “site-days”
- Not all exceedances in the 2018-2020 period were significant for the final attainment decision
- PM2.5 concentrations on exceedance days ranged from:
  - 68 µg/m³ to 159 µg/m³

Table 1-2: Exceedances of the 1997 PM2.5 NAAQS at select San Joaquin Valley sites

	PM2.5 Concentration (µg/m³)				
Site Name	8/20/2020	8/21/2020	8/22/2020	8/23/2020	8/24/2020
Stockton-Hazelton	88.8	76.3		65.9*	78.2
Manteca	102	100.8		79.3	87.6
Modesto-14th St.	102.2	90.1	68	67.6	84.7
Turlock	108	96.5	97.2	67.7*	99.1
Fresno-Foundry	74.9	128.3	153.5	100.5	99.4
Hanford-Irwin	77*	135.1	147	116.7	107
Corcoran	69*	115.2	140.1	93.2	89.8
Bakersfield-Planz			158.6		

Full demo @ EPA “Example EE Demonstrations” Webpage:
https://www.epa.gov/air-quality-analysis/example-demonstrations-and-epa-responses-prepared-under-2016-exceptional#PM

Recent Success: 1997 24-hour PM2.5 NAAQS

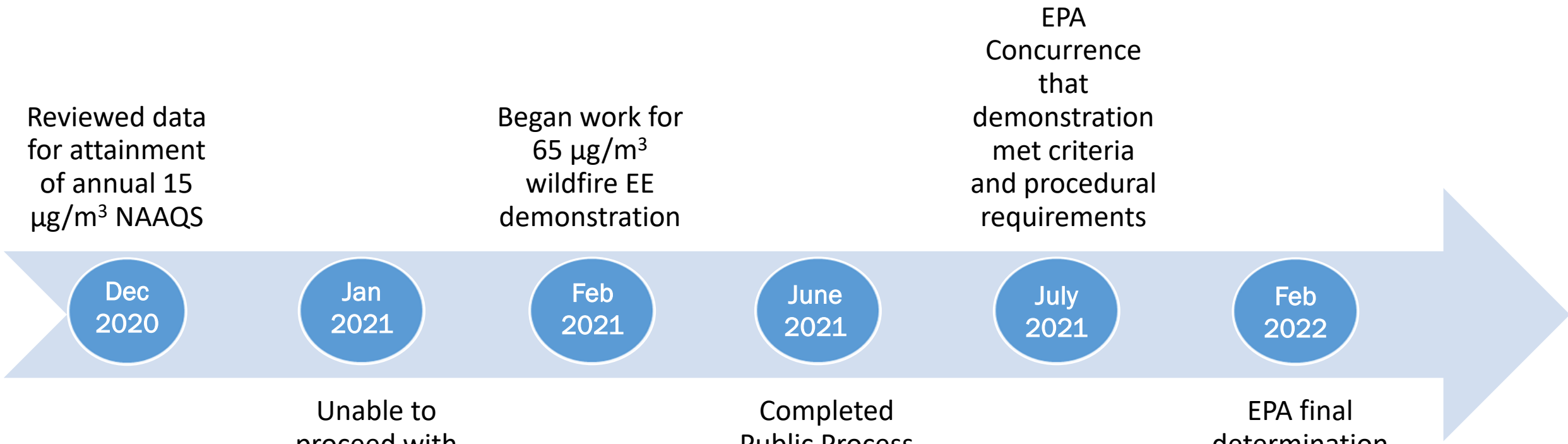


SJV Attainment

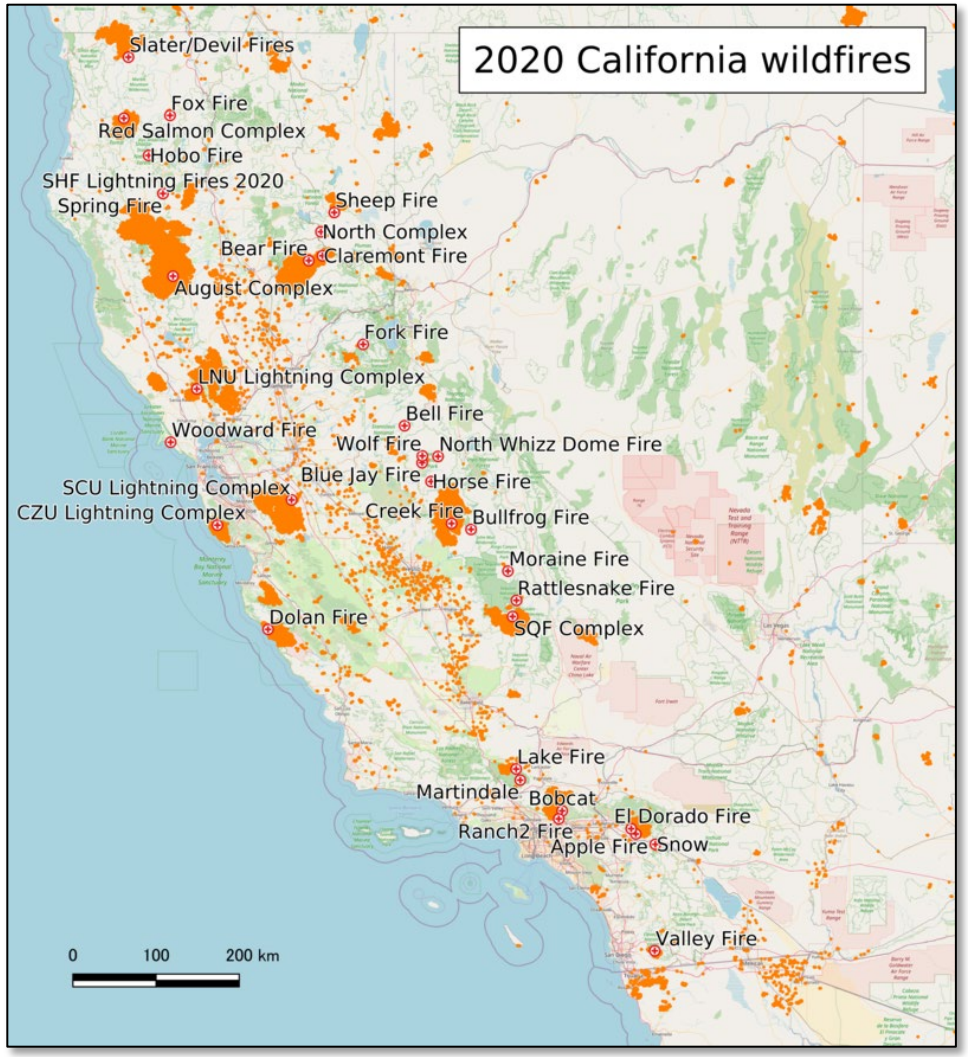
1997 24-hour NAAQS

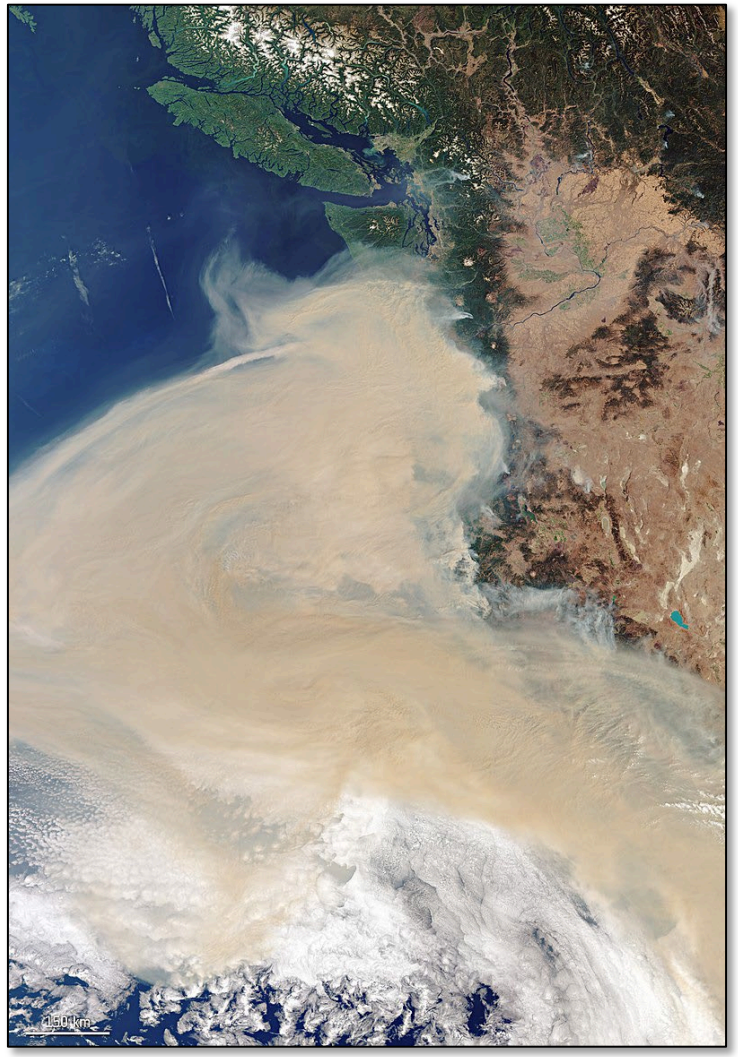
- EE Demonstration for 2020 wildfires set path for EPA determination that SJV area attained 65 µg/m^3 24-hour NAAQS

Timeline for Successful Wildfire EE Demo for 1997 24-hour PM2.5 NAAQS



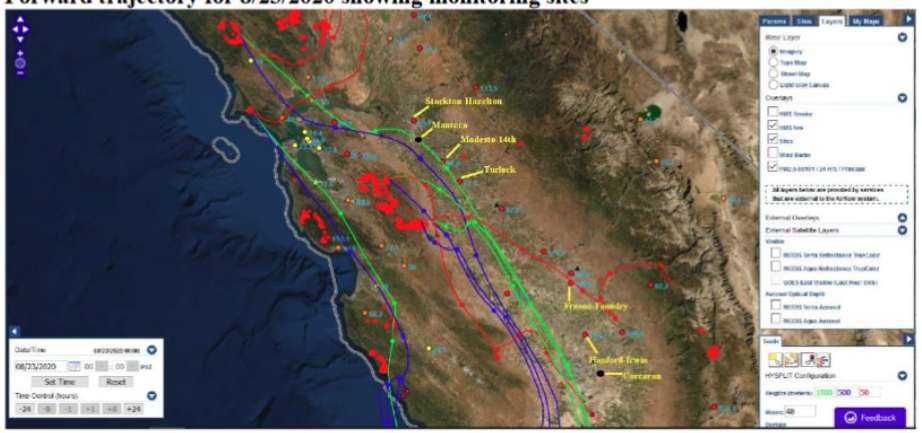
2020/21 Impacted by Numerous Wildland Fires





2020/21 Impacted by Numerous Wildland Fires

Forward trajectory for 8/23/2020 showing monitoring sites



Forward trajectory for 8/23/2020 showing monitoring sites with smoke layer

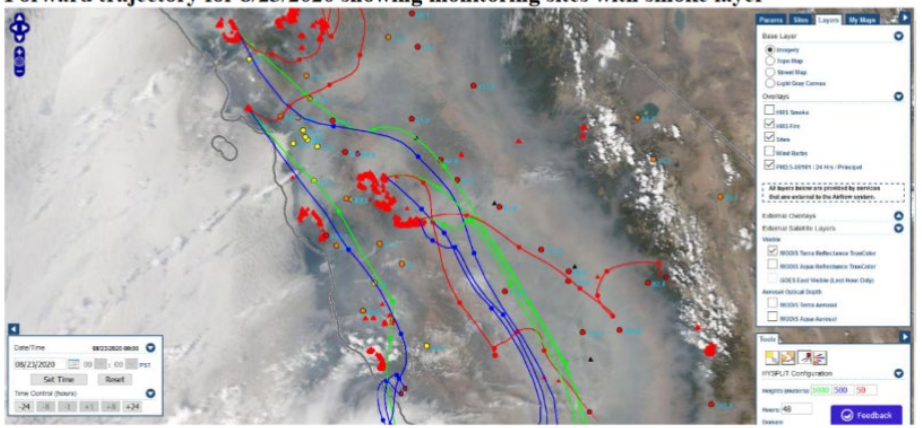
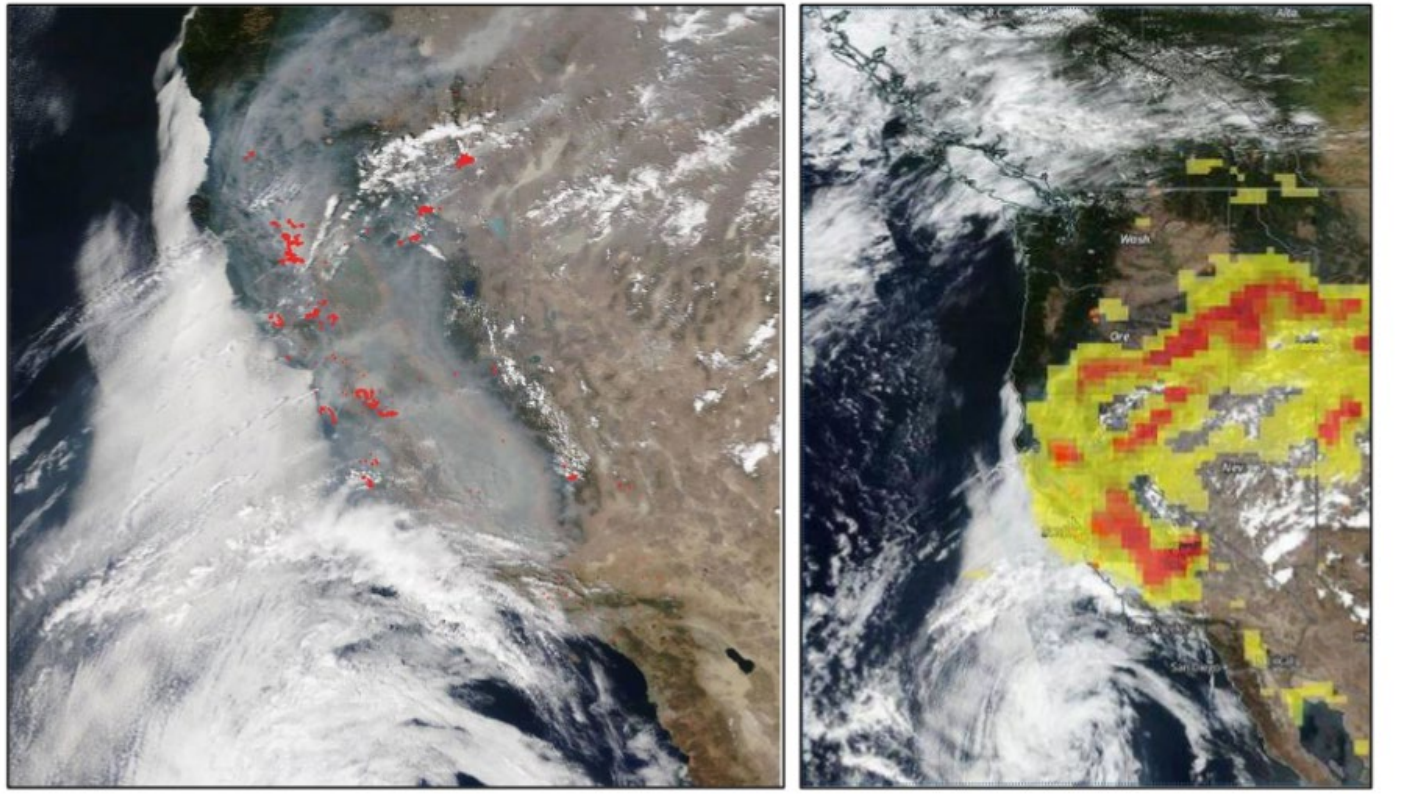
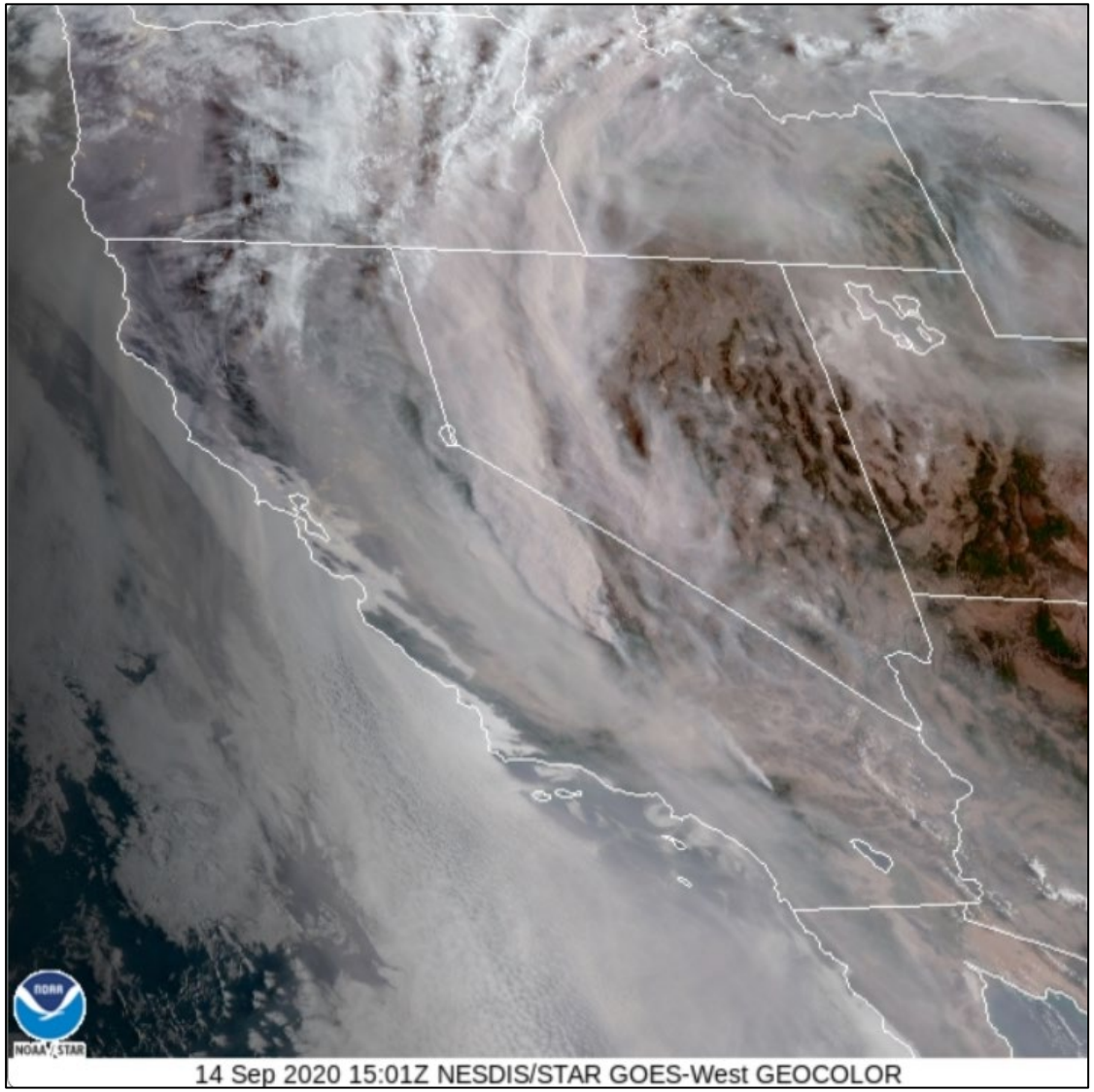


Figure 3-10: Terra Satellite (left) and Suomi NPP (right) Aerosol on August 24, 2020



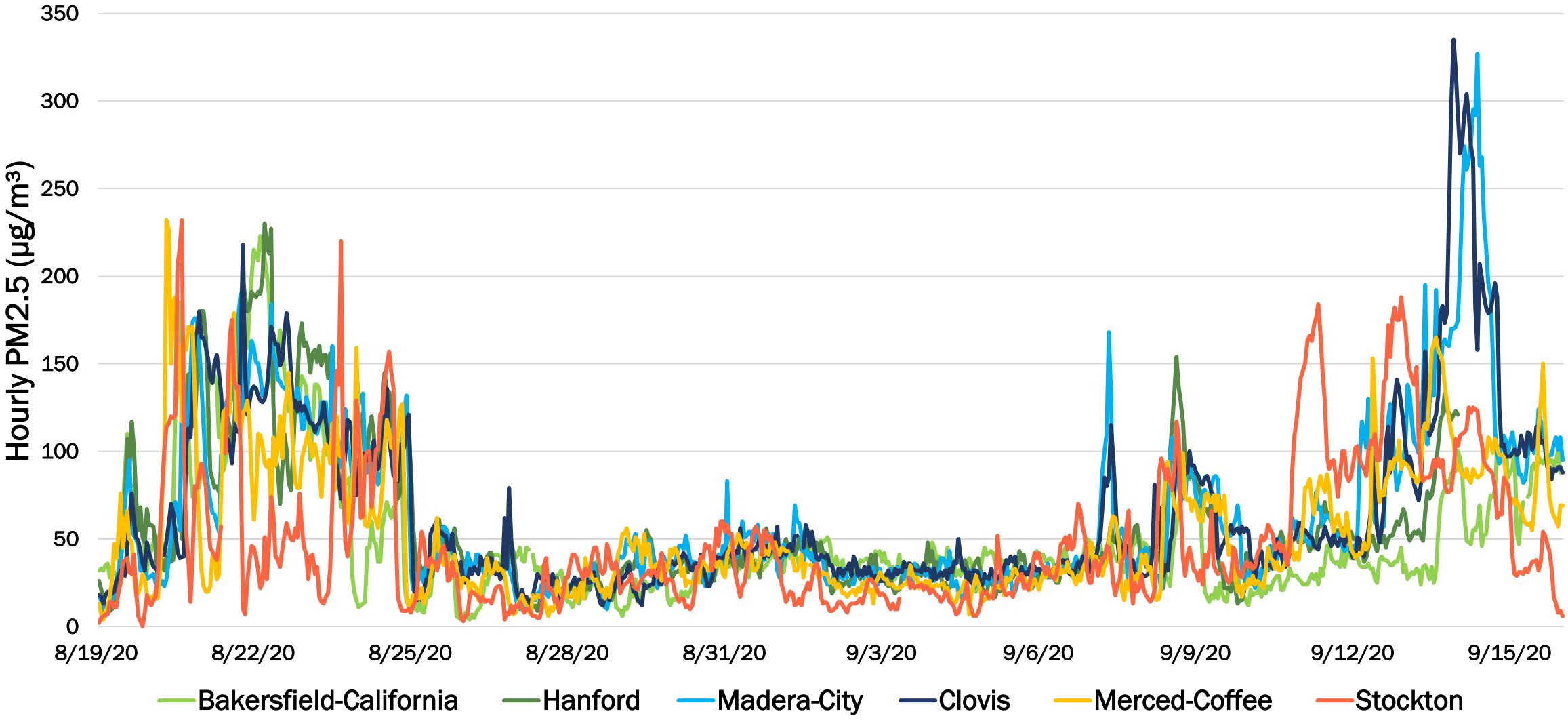
Creek Fire Pyrocumulonimbus Cloud (Sep 5, 2020)

Satellite Image of Western U.S. (Sep 14, 2020)

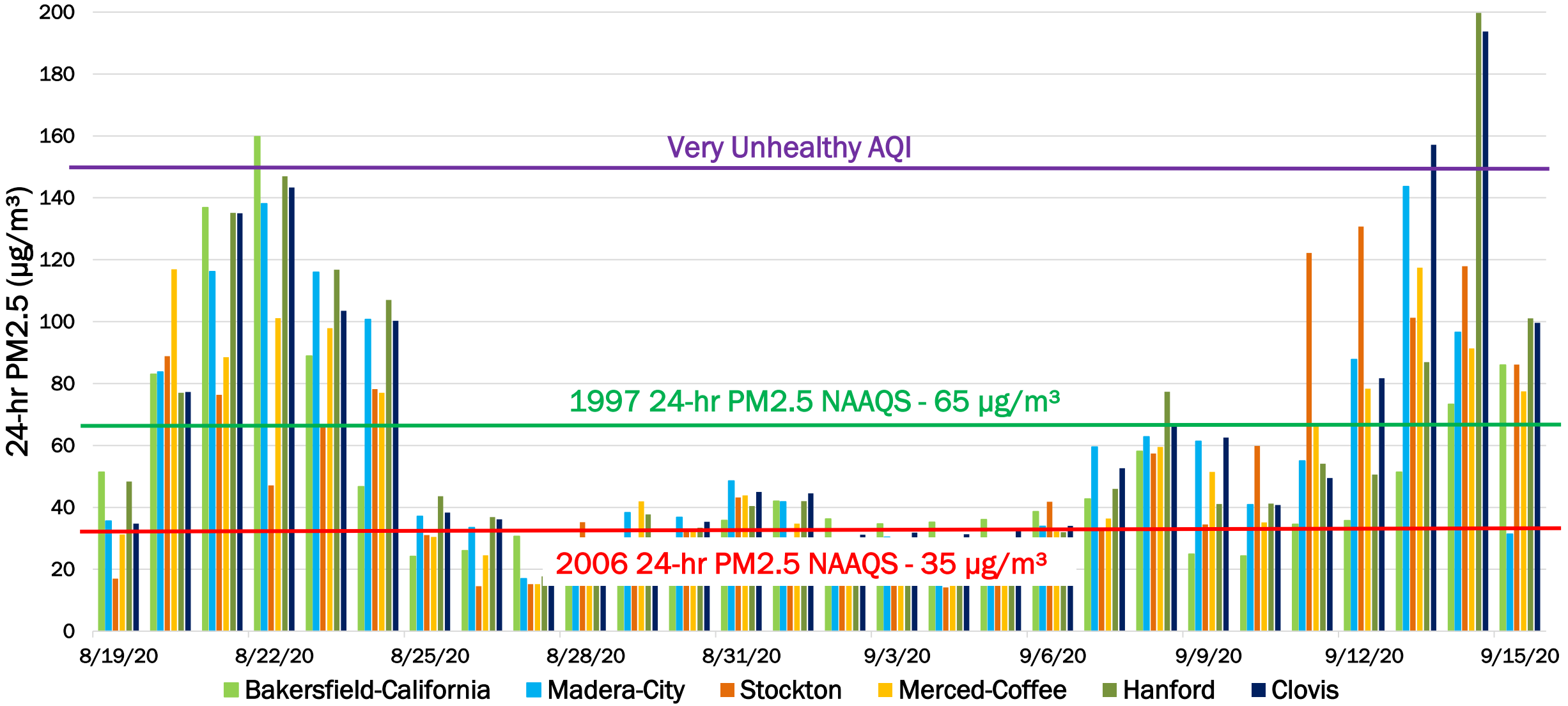


Smoke Impacts in Fresno, CA

Wildfires Impacted Hourly PM2.5 Concentrations



Wildfires Impacted Daily PM2.5 Concentrations



Recent Unsuccessful Demonstration: Annual PM2.5 NAAQS

1997 PM2.5 NAAQS

15 µg/m³ Annual Standard

2019-2021 DV

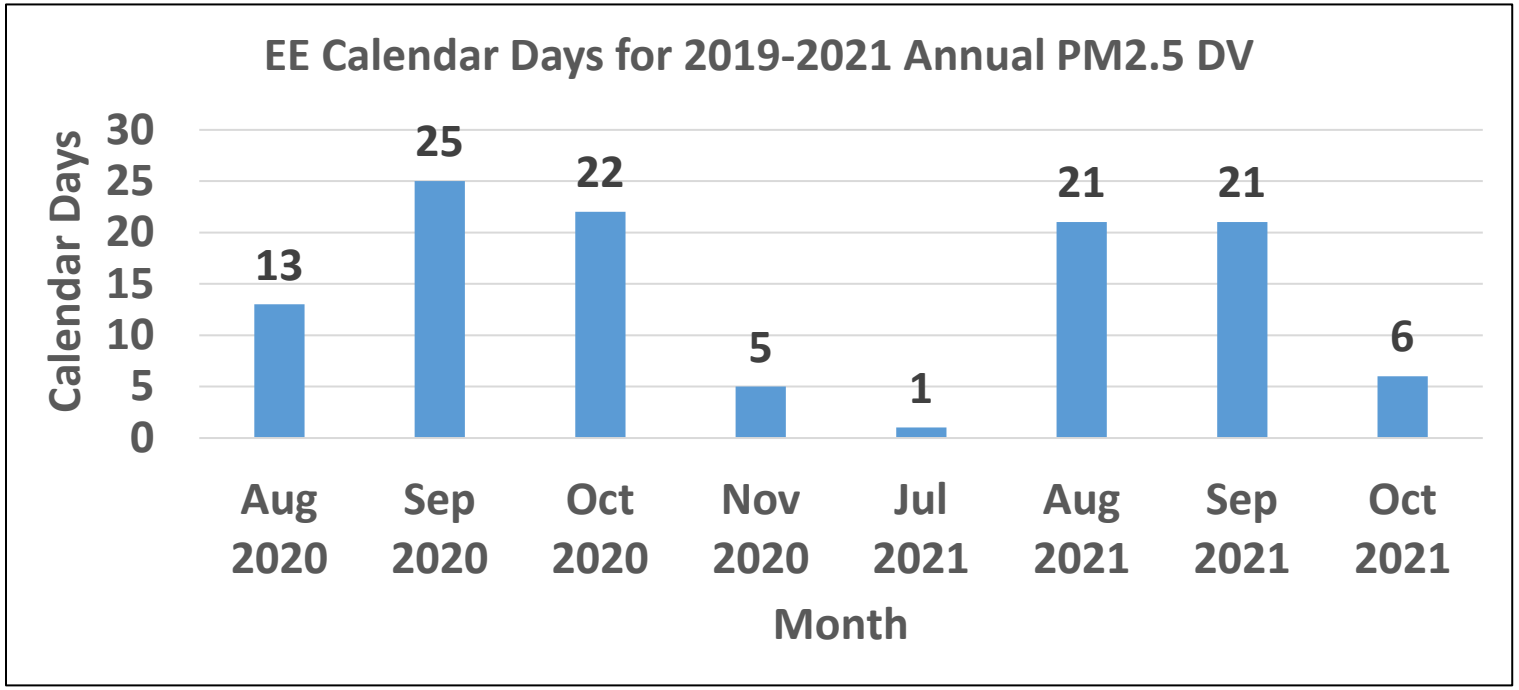
Non-Attaining Design Value impacted by smoke from wildfires

2020 & 2021 Events

- 7 sites
- 114 dates
- 220 site-days
- Wildfires and Fireworks Events

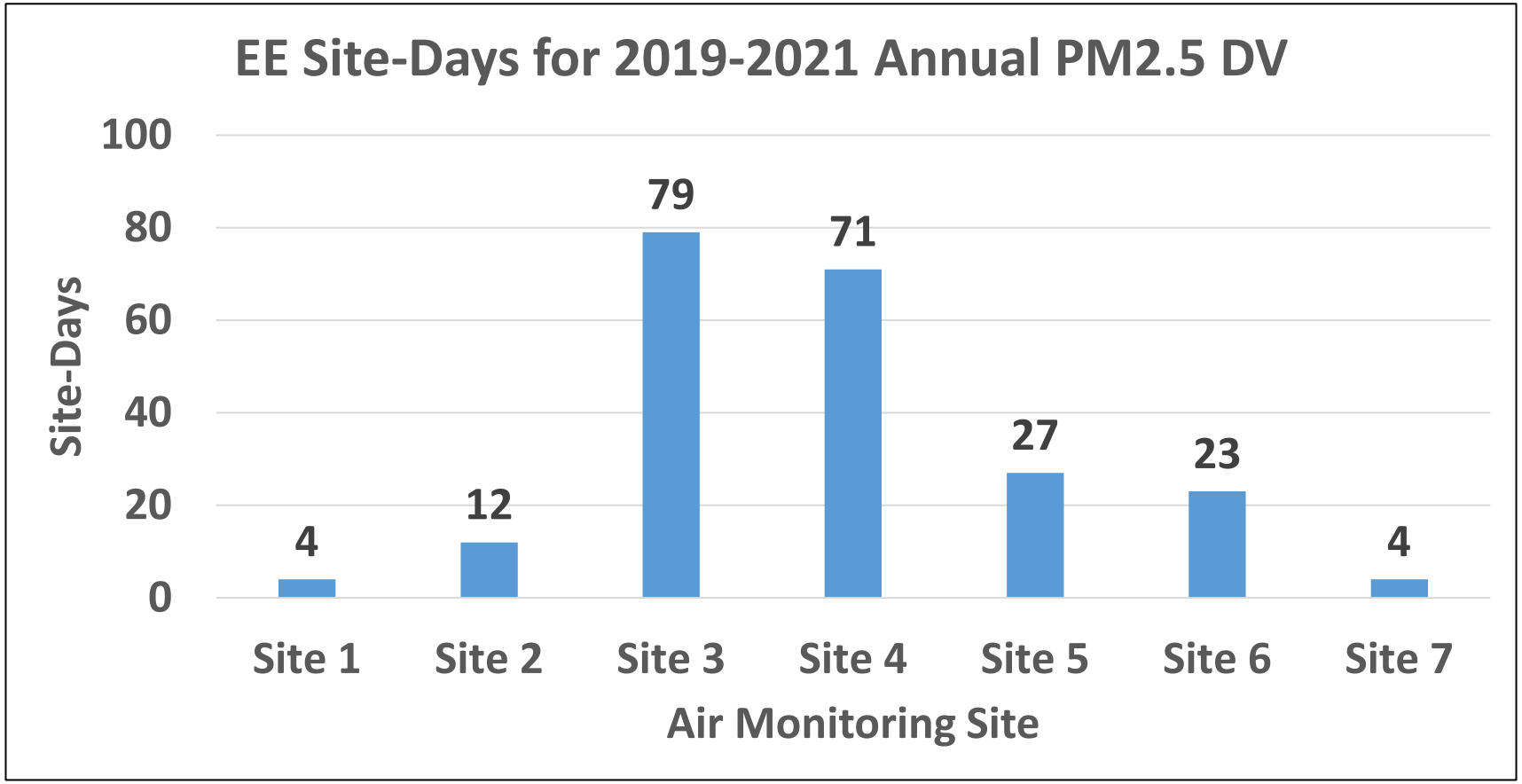
Recent Unsuccessful Demonstration: Annual PM2.5 NAAQS

- Multiple wildfires in 2020 and 2021 caused prolonged smoke impacts in the SJV across all air monitoring sites
  - Continuous weeks/months of heavy wildfire smoke impacts
- 7 air monitoring sites had non-attaining annual PM2.5 design values for 2019-2021 period
- 114 calendar dates where exceedances were significant to the attainment decision



Recent Unsuccessful Demonstration: Annual PM2.5 NAAQS

- 220 site-days
- Approach to analysis was to organize as three demonstration documents
  - 1 for 2020 wildfires
  - 1 for 2021 wildfires
  - 1 for 2021 fireworks



Recent Unsuccessful Demonstration: Annual PM2.5 NAAQS

- Each wildfire EE demo included the following, regardless of concentration level:
  - Overview and description of each of the multiple fires
  - Trajectories and satellite imagery for every calendar day
  - Historical site concentrations and evidence of smoke for each site-day
  - PM2.5 speciation analysis, PM2.5/CO ratio analysis
  - Included extra evidence for “difficult” site days (e.g. ceilometer data)
- Over 5,000 pages of documentation and evidence was prepared
  - Represented months of work and thousands of hours of staff time
  - Extensive coordination with CARB and EPA Region 9
  - Difficult for any agency to review this volume of analysis

Lessons from Unsuccessful Demonstration

- EE analysis for annual standard required documentation of lower concentration days near the 15 µg/m^3 standard
  - Difficult to meet historical comparison tests - will become a more common issue with the 9 µg/m^3 standard
  - No clear guidance at time for "right-sized" analysis for easy vs. difficult EE days
  - Overall, EE process does not work well for annual standard when needing to document long list of days
- Time needed to prepare this size of evidence of EE impacts caused timing issues with meeting statutory deadlines
  - Certification of data happens by May 1
  - Time needed for review by public, state, and EPA regional office
  - EPA timeline for concurrence and final decision could conflict with standard attainment deadlines, could require additional year of data to be considered, etc.

Looking to the Future

- Exceptional events expected to remain a key factor in initial designations and demonstrating attainment for multiple NAAQS
  - Will be larger national focus for 9 µg/m^3 annual PM2.5 standard
- New EPA analysis tools including Tiering guidance should help to "right-size" demonstrations
  - Improved preparation/review time for all parties (local, state, federal)
- Early and close coordination with CARB and EPA Region 9 on exceedances impacted by exceptional events a key factor to minimize timing constraints and conflicts

Thank You!