

## **ENCLOSURE: TECHNICAL SUPPORT DOCUMENT FOR EPA CONCURRENCE ON OZONE EXCEEDANCES MEASURED IN COACHELLA VALLEY, CALIFORNIA ON JULY 14-15, 2023 AS AN EXCEPTIONAL EVENT**

On September 12, 2024, the California Air Resources Board (CARB) submitted an exceptional event demonstration (“Demonstration”) prepared by the South Coast Air Quality Management District (“South Coast AQMD”) for exceedances of the 1997 8-hour ozone National Ambient Air Quality Standards (NAAQS) of 0.08 parts per million (ppm) that occurred at the Palm Springs – Fire Station monitoring site on July 14-15, 2023, located within the Riverside County (Coachella Valley), California, nonattainment area (“Coachella Valley”).<sup>1</sup> The Demonstration states that the exceedances were caused by multiple wildfires burning in the southern portion of California, namely the Highland, Rabbit, and Reche fires.<sup>2</sup> Under the Exceptional Events Rule, air agencies can request the exclusion of event-influenced data, and the EPA can agree to exclude these data, from the data set used for certain regulatory decisions. The remainder of this document summarizes the Exceptional Events Rule requirements, the event, and the EPA’s review process.

### **EXCEPTIONAL EVENTS RULE REQUIREMENTS**

The EPA promulgated the Exceptional Events Rule in 2007, pursuant to the 2005 amendment of Clean Air Act (CAA) Section 319. In 2016, the EPA finalized revisions to the Exceptional Events Rule. The 2007 Exceptional Events Rule and 2016 Exceptional Events Rule revisions added sections 40 CFR §50.1(j)-(r); §50.14; and §51.930 to title 40 of the Code of Federal Regulations (CFR). These sections contain definitions, criteria for EPA approval, procedural requirements, and requirements for air agency demonstrations. The EPA reviews the information and analyses in the air agency's demonstration package using a weight of evidence approach and decides to concur or not concur. The demonstration must satisfy all of the Exceptional Events Rule criteria for the EPA to concur with excluding the air quality data from regulatory decisions.

Under 40 CFR §50.14(c)(3)(iv), the air agency demonstration to justify exclusion of data must include:

- 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;”

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<sup>1</sup> “Rabbit, Reche, and Highland Wildfires Ozone Exceptional Events Demonstration” South Coast Air Quality Management District (September 2024).

<sup>2</sup> See Demonstration, pp. 39-47.

- C. “Analyses comparing the claimed event-influenced concentration(s) to concentrations at the same monitoring site at other times” to support requirement (B) above;
- 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 particular location or was a natural event.”<sup>3</sup>

In addition, the air agency must meet several procedural requirements, including:

1. submission of an Initial Notification of Potential Exceptional Event and flagging of the affected data in the EPA's Air Quality System (AQS) as described in 40 CFR §50.14(c)(2)(i),
2. completion and documentation of the public comment process described in 40 CFR §50.14(c)(3)(v), and
3. implementation of any relevant mitigation requirements as described in 40 CFR §51.930.

For data influenced by exceptional events to be used in initial area designations, air agencies must also meet the initial notification and demonstration submission deadlines specified in Table 2 to 40 CFR §50.14. We include below a summary of the Exceptional Events Rule criteria, including those identified in 40 CFR §50.14(c)(3)(iv).

### **Regulatory Significance**

The 2016 Exceptional Events Rule includes regulatory language that applies the provisions of CAA section 319 to a specific set of regulatory actions. As identified in 40 CFR §50.14(a)(1)(i), these regulatory actions include initial area designations and redesignations; area classifications; attainment determinations (including clean data determinations); attainment date extensions; findings of State Implementation Plan (SIP) inadequacy leading to a SIP call; and other actions on a case-by-case basis as determined by the Administrator. Air agencies and the EPA should discuss the regulatory significance of an exceptional events demonstration during the Initial Notification of Potential Exceptional Event prior to the air agency submitting a demonstration for the EPA's review.

### **Narrative Conceptual Model**

The 2016 Exceptional Events Rule directs air agencies to submit, as part of an exceptional events demonstration, a narrative conceptual model of the event that describes and

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<sup>3</sup> A natural event is further described in 40 CFR 50.1(k) as “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.”

summarizes the event in question and provides context for analyzing the required statutory and regulatory technical criteria. Air agencies may support the narrative conceptual model with summary tables or maps. For wildfire ozone events, the EPA recommends that the narrative conceptual model also discuss the interaction of emissions, meteorology, and chemistry of event and non-event ozone formation in the area. The narrative should also describe the regulatory significance of the proposed data exclusion under 40 CFR §50.14(a)(1)(i).

### **Clear Causal Relationship and Supporting Analyses**

The EPA considers a variety of evidence when evaluating whether there is a clear causal relationship between a specific event and the monitored exceedance or violation. For wildfire ozone events, air agencies should compare the ozone data requested for exclusion with seasonal and annual historical concentrations at the air quality monitor to establish a clear causal relationship between the event and monitored data. In addition to providing this information on the historical context for the event-influenced data, air agencies should further support the clear causal relationship criterion by demonstrating that the wildfire's emissions were transported to the monitor, and that the emissions from the wildfire influenced the monitored concentrations. In some cases, air agencies may need to provide evidence of the contribution of the wildfire's emissions to the monitored ozone exceedance or violation.

For wildfire ozone events, the EPA has published a guidance document that provides three different tiers of analyses that apply to the "clear causal relationship" criterion within an air agency's exceptional events demonstration.<sup>4</sup> This tiered approach recognizes that some wildfire events may be more clear and/or extreme and, therefore, require relatively less evidence to satisfy the rule requirements. If a wildfire/ozone event satisfies the key factors for either Tier 1 or Tier 2 clear causal analyses, then those analyses are the only analyses required to support the clear causal relationship criterion within an air agency's demonstration for that particular event. Other wildfire/ozone events will be considered based on Tier 3 analyses.

- **Tier 1:** Wildfires that clearly influence monitored ozone exceedances or violations when they occur in an area that typically experiences lower ozone concentrations.
  - *Key Factor:* seasonality and/or distinctive level of the monitored ozone concentration. The event-related exceedance occurs during a time of year that typically has no exceedances, or is clearly distinguishable (e.g., 5-10 ppb higher) from non-event exceedances.
  - In these situations, ozone impacts should be accompanied by clear evidence that the wildfire's emissions were transported to the location of the monitor.
- **Tier 2:** The wildfire event's ozone influences are higher than non-event-related concentrations, and fire emissions compared to the fire's distance from the affected monitor indicate a clear causal relationship.

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<sup>4</sup> "Guidance on the Preparation of Exceptional Events Demonstrations for Wildfire Events that May Influence Ozone Concentrations" (September 2016).

- *Key Factor 1*: fire emissions and distance of fire(s) to affected monitoring site location(s). Calculated fire emissions of NO<sub>x</sub> and reactive-VOC in tons per day (Q) divided by the distance from the fire to the monitoring site (D) should be equal to or greater than 100 tons per day/kilometers (Q/D ≥ 100 tpd/km). The guidance document provides additional information on the calculation of Q/D.
- *Key Factor 2*: comparison of the event-related ozone concentration with non-event related high ozone concentrations. The exceedance due to the exceptional event:
  - is in the 99<sup>th</sup> or higher percentile of the 5-year distribution of ozone monitoring data, OR
  - is one of the four highest ozone concentrations within 1 year (among those concentrations that have not already been excluded under the Exceptional Events Rule, if any).
- In addition to the analysis required for Tier 1, the air agency should supply additional evidence to support the weight of evidence that emissions from the wildfire affected the monitored ozone concentration.
- **Tier 3**: The wildfire does not fall into the specific scenarios (i.e., does not meet the key factors) that qualify for Tier 1 or Tier 2, but the clear causal relationship criterion can still be satisfied by a weight of evidence showing.
  - In addition to the analyses required for Tier 1 and Tier 2, an air agency may further support the clear causal relationship with additional evidence that the fire emissions caused the ozone exceedance.

### **Not Reasonably Controllable or Preventable**

The Exceptional Events Rule requires that air agencies establish that the event be both not reasonably controllable and not reasonably preventable at the time the event occurred. This requirement applies to both natural events and events caused by human activities; however, it is presumed that wildfires on wildland will satisfy both factors of the “not reasonably controllable or preventable” element unless evidence in the record clearly demonstrates otherwise.<sup>5</sup>

### **Natural Event**

According to the CAA and the Exceptional Events Rule, an exceptional event must be “an event caused by human activity that is unlikely to recur at a particular location or a natural event”. The 2016 Exceptional Events Rule includes in the definition of wildfire that “[a] wildfire that predominantly occurs on wildland is a natural event.” Once an agency provides evidence that a wildfire on wildland occurred and demonstrates that there is a clear causal relationship

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<sup>5</sup> A wildfire is defined in 40 CFR 50.1(n) as “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.” Wildland is defined in 40 CFR 50.1(o) 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.”

between the measurement under consideration and the event, the EPA expects minimal documentation to satisfy the “human activity that is unlikely to recur at a particular location or a natural event” element. The EPA will address wildfires on other lands on a case-by-case basis.

## **EPA REVIEW OF EXCEPTIONAL EVENTS DEMONSTRATION**

On January 2, 2024, CARB and South Coast AQMD submitted an Initial Notification of a Potential Exceptional Event for four exceedances of the 1997 8-hour ozone NAAQS that occurred at the Palm Springs – Fire Station monitoring site within Coachella Valley on June 17-18, 2021 and July 14-15, 2023.<sup>6</sup> On September 12, 2024, CARB submitted the Demonstration prepared by South Coast AQMD for the two exceedances identified for July 14-15, 2023.<sup>7</sup>

### **Regulatory Significance**

The EPA determined that data exclusion of some of the exceedances referenced in the Initial Notification had potential regulatory significance for a one-year extension of the attainment deadline for the 1997 8-hour ozone NAAQS, and worked with CARB and South Coast AQMD to identify the relevant exceedances and monitoring site affected.<sup>8</sup> The “Regulatory Significance” section of the Demonstration includes details on the regulatory significance of the claimed exceptional events, noting that the EPA’s concurrence would result in a 2023 4<sup>th</sup> 8-hour daily maximum concentration below the level of the 1997 ozone NAAQS, which is a requirement for eligibility of the one-year extension.<sup>9</sup> Table 1 summarizes the exceedances that South Coast AQMD included in the Demonstration.

Table 1: 1997 8-hour Ozone NAAQS Exceedance Summary

<b>Exceedance Date</b>	<b>Monitoring Site Name</b>	<b>AQS ID</b>	<b>1997 8-hour Avg. (ppm)</b>
July 14, 2023	Palm Springs – Fire Station	06-065-5001	0.093
July 15, 2023	Palm Springs – Fire Station	06-065-5001	0.086

### **Narrative Conceptual Model**

The Demonstration provides a narrative conceptual model in the sections identified in Table 2, which describe generally how emissions from the fires in southern California caused the ozone exceedances at the Palm Springs – Fire Station monitoring site. The “Introduction” and “Area Description for Coachella Valley” chapters provide information to support the narrative conceptual model, including characteristics of the nonattainment area and upwind areas, such as descriptions of typical ozone concentrations, emissions sources, typical non-event seasonal and diurnal ozone patterns, the ambient ozone monitoring network, meteorology, geography, topography, typical ozone transport and formation, and non-event comparisons between nearby monitors.<sup>10</sup> The narrative conceptual model includes characteristics of the event. These

<sup>6</sup> See email from Jin Xu, CARB, to Dena Vallano, EPA Region 9, dated January 2, 2024.

<sup>7</sup> See letter from Michael Benjamin, CARB, to Matthew Lakin, EPA Region 9, dated September 12, 2024.

<sup>8</sup> See letter from Matthew Lakin, EPA Region 9, to Michael Benjamin, CARB, dated February 29, 2024.

<sup>9</sup> See Demonstration, pp. 28-33.

<sup>10</sup> See Demonstration pp. 20-28, 33-39.

include a summary of the specific descriptions of wildfires that generated emissions contributing to the ozone exceedances at the Palm Springs – Fire Station monitoring site. The “Wildfire Description for Rabbit, Reche, and Highland Wildfires” section provides a summary of each of the three wildfires that includes the latitude and longitude for the first reported location, start date, containment date, and cause. The Demonstration provides tables for each of the three wildfires that includes the one-day growth in acres on each of the event days, status reports for each day, and the source website, along with maps of the burn perimeters.<sup>11</sup>

The “Area Description for Coachella Valley” section describes the physical location as well as typical concentrations, emissions sources, and seasonal and diurnal ozone patterns under typical, non-event circumstances. The Palm Springs – Fire Station monitor is in the Coachella Valley, within the desert portion of Riverside County. The Coachella Valley is separated from the South Coast Air Basin by the Banning Pass (also called the San Gorgonio Pass) in the east to west direction. The narrow Banning Pass (2-3 miles in width) is bounded on the north by the San Bernardino Mountains and on the South by the San Jacinto Mountains.<sup>12</sup> Ozone concentrations measured at the Palm Springs – Fire Station monitor are a result of locally-generated and transported ozone and ozone precursors from upwind areas, most commonly the South Coast Air Basin based on typical meteorology.<sup>13</sup>

To address seasonal and diurnal ozone patterns under typical, non-event circumstances, the Demonstration provides a graph of 3-year average diurnal profiles of ozone at the Palm Springs – Fire Station monitor and upwind monitors. The graph indicates that ozone concentrations typically peak earlier in the day at the monitors in the west and closer to the main emissions sources in the South Coast Air Basin, and again later in the day in the eastern portion of the South Coast Air Basin. Moving further eastward into the Coachella Valley, ozone concentrations mostly plateau between late morning and into the evening. The magnitude of the peaks are lower closer to the emissions sources in the eastern portion and higher downwind in the west portion of the South Coast Air Basin, and then lower again moving eastward into the Coachella Valley.<sup>14</sup>

The “Interaction of Wildfire Emissions, Meteorology, and Pollutant Concentrations” section describes the event. The Highland, Rabbit and Reche fires all started between 11:58 AM PST and 2:30 PM PST. Both Hybrid Single Particle Lagrangian Integrated Trajectory (HYSPLIT) trajectory modeling and surface meteorology on July 14, 2023, indicated westerly winds transporting smoke from the fires into the Coachella Valley to the Palm Springs – Fire Station monitor from around 4:00 PM PST to 2:00 AM PST the following day. Around 6:00 AM PST on July 15, 2023, a wind reversal occurred, indicating a recirculation of the smoke back to the Palm Springs – Fire Station site.

In addition, the Demonstration includes hourly HYSPLIT model results to support that wildfire emissions were transported to the Palm Springs – Fire Station monitoring site on July 14-15,

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<sup>11</sup> See Demonstration pp. 39-47.

<sup>12</sup> See Demonstration pp. 33-35

<sup>13</sup> See Demonstration pp. 36-39

<sup>14</sup> See Demonstration pp. 36-38.

2023. The Demonstration supports this narrative by providing a table of an hour-by hour summary of each forward launch time (forward trajectories) and related smoke arrival time to the Palm Springs area with the identified fire source and corresponding evidence of increased ozone, nitrogen oxides (NO<sub>x</sub>), and carbon monoxide (CO).<sup>15</sup> The Demonstration includes another table with an hour-by-hour summary of each back trajectory passing near the burn area, showing the time of arrival of smoke to the Palm Springs area with the identified fire source.<sup>16</sup> Notably, the running 8-hour average for the Palm Springs – Fire Station monitor on July 15, 2023 indicates that without the early morning hours, the day would not have exceeded the level of the 1997 8-hour ozone NAAQS.<sup>17</sup>

The “Public Notification during Event” section of the Demonstration includes an air quality advisory issued by South Coast AQMD within hours of start of the fires, anticipating that wildfire smoke would cause the Air Quality Index (AQI) in Coachella Valley to reach “unhealthy for sensitive groups” to “unhealthy” levels on July 14, 2023, and “unhealthy” to “hazardous” on July 15, 2023. The Demonstration states that an ozone advisory was in place prior to the start of the fires for the South Coast Air Basin and Coachella Valley; however, the advisory was based off a forecasted 8-hour average daily maximum above the level of the 1997 8-hour ozone NAAQS for the South Coast Air Basin, but below the level of the 1997 8-hour ozone NAAQS for the Coachella Valley. The “News Articles” section of the Demonstration provides several news reports of smoke from the fires resulting in poor visibility and air quality.

Based on the description of the fires, narrative of the event, analysis of typical non-event seasonal and diurnal ozone patterns, AQI advisories due to wildfire smoke, and news articles describing the fires and related air quality impacts, the Demonstration meets the narrative conceptual model criterion of the exceptional events rule.

Table 2: Documentation of the Narrative Conceptual Model

Exceedance Date	Demonstration Citation	Quality of Evidence	Criterion Met?
July 14-15, 2023	<p>“Introduction” (Section 5): pp. 20-22</p> <p>“Area Description for Coachella Valley” (Section 7): pp. 33-39</p> <p>“Wildfire Description for Rabbit, Reche, and Highland Wildfires” (Section 8): pp. 39-47</p> <p>“Public Notification during Event” (Section 9): pp. 47-49</p> <p>“News Articles” (Section 10): pp. 49</p> <p>“Interaction of Wildfire Emissions, Meteorology, and Pollutants Concentrations” (Section 11): pp. 49-71</p>	Sufficient	Yes

<sup>15</sup> See Demonstration p. 51.

<sup>16</sup> See Demonstration p. 52.

<sup>17</sup> See Demonstration pp. 53-54.

## Clear Causal Relationship

The Demonstration includes several analyses to support a clear causal relationship between the wildfire event and the monitored exceedances. These analyses are presented in the sections identified in Table 3.

### Comparison with historical concentrations

The Demonstration includes a comparison with historical concentrations, as required by 40 CFR §50.14(c)(3)(iv)(C). This comparison addresses ozone concentrations at the Palm Springs – Fire Station monitoring site on July 14-15, 2023, relative to historical, seasonal (May 30 to August 29) ozone concentrations between 2019 and 2023. The “Historical Analysis for Rabbit, Reche, and Highland Wildfires” section includes a graph of daily maximum 8-hour average concentrations over the five-year period by day of year, the level of the 1997 ozone NAAQS, and the 98<sup>th</sup> percentile value at the site, with possible smoke-influenced days noted but included.<sup>18</sup> The Demonstration notes that the ozone concentrations measured on July 14-15, 2023 were similar to those measured during other wildfires.<sup>19</sup>

The Demonstration also compares historical diurnal ozone concentrations at the Palm Springs – Fire Station site to hourly concentrations observed on July 14-15, 2023. On July 14, 2023, six out of the eight hours that comprised the maximum 8-hour averaged daily concentration were above the 95<sup>th</sup> percentile of the historical diurnal pattern, and four out of the eight hours were above the 99<sup>th</sup> percentile. On July 15, 2023, seven out of the eight hours that comprised the maximum 8-hour averaged daily concentration were above the 95<sup>th</sup> percentile of the historical diurnal pattern, and six out of the eight hours were above the 99<sup>th</sup> percentile.<sup>20</sup> Also, on July 15, 2023, the start hour of the maximum 8-hour averaged daily concentration was at 6 am PST, while the historical pattern indicated a usual start hour around 11 am PST, demonstrating an unusual diurnal profile.<sup>21</sup>

### Tier 1: Key Factor

To meet the key factor for a Tier 1 analysis, exceedances should be clearly higher than other non-event-related exceedances, or occur during a time of year that typically experiences no exceedances. The exceedances identified in the Demonstration occurred within the ozone season when exceedances have historically been observed at the Palm Springs – Fire Station monitoring site. The ozone concentrations at Palm Springs – Fire Station on event days identified in this Demonstration do not exceed non-event exceedance concentrations by at least five parts per billion (ppb).<sup>22</sup> Therefore, the exceedances do not meet the Tier 1 Key Factor, and additional evidence beyond a Tier 1 analysis is needed to support the clear causal relationship.

### Tier 2: Key Factors

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<sup>18</sup> See Demonstration pp. 71-72.

<sup>19</sup> See Demonstration pp. 77-78.

<sup>20</sup> See Demonstration pp. 74-75.

<sup>21</sup> See Demonstration pp. 75-76.

<sup>22</sup> See Demonstration, pp. 73-74.

The Demonstration includes an evaluation of the Tier 2 Key Factors. For Tier 2 Key Factor 1, the Demonstration provides an analysis of fire emissions (Q) and distance (D) of the wildfires to the monitoring site locations. The “Q/D Analysis for July 14, 2023” and “Q/D Analysis for July 15, 2023” sections of the Demonstration state that South Coast AQMD calculated Q/D as described in Step 7 of Section 3.5.1 of the EPA’s exceptional events guidance for wildfire events.<sup>23</sup> Per the EPA’s guidance, the Q/D value is calculated by dividing wildfire emissions (in tons per day) by the distance between the wildfire and the monitoring site (in kilometers [km]). The Demonstration derives Q value for the Highland, Rabbit, and Reche fires for three days, including the prior date (July 13, 2023), first date (July 14, 2023), and last date (July 15, 2023), calculating the D value as the weighted distance between the fires and the monitoring site. The distance-weighted sum is 10 tons per day of NO<sub>x</sub> and VOC per km on July 14, 2023 and 16 tons per day of NO<sub>x</sub> and VOC per km on July 15, 2023, which are below the Tier 2 Key Factor 1 screening value of 100 tons per day/km.<sup>24</sup> Therefore, the event exceedances do not meet Tier 2 Key Factor 1.

For Tier 2 Key Factor 2, the Demonstration includes evidence that the exceedance on July 14, 2023 is at or above the 99<sup>th</sup> percentile from the past five years of ozone season data (May 30-August 29, 2019-2023) and is among the four highest concentrations measured at the site in 2023. The exceedance on July 15, 2023 is not above the 99<sup>th</sup> percentile from the past five years of ozone season data (May 30-August 29 2019-2023) but is among the four highest concentrations measured at the site in 2023.<sup>25</sup> Therefore, the event exceedances meet Tier 2 Key Factor 2. However, as noted above, the event exceedances do not meet Tier 2 Key Factor 1, so the EPA is not considering this event under Tier 2.

Based on the analysis of the Key Factors for Tier 2, the EPA’s wildfire ozone guidance document indicates that a Tier 3 analysis is appropriate for this event. As described below, the Demonstration includes the required elements for a Tier 3 clear causal relationship analysis based on the EPA’s wildfire ozone guidance document. This includes evidence that (1) the wildfire emissions were transported from the wildfire to the monitor; (2) the wildfire emissions affected the monitor; and (3) the wildfire emissions caused the ozone exceedances.

#### Evidence of transport of wildfire emissions from the wildfire to the monitor

The Demonstration includes the “HYSPLIT Forward Trajectories Report for July 14-15, 2023” and “HYSPLIT Back Trajectories Report for July 14-15, 2023,” which use forward trajectory and back trajectory modeling to estimate the movement of air parcels and smoke during the event time period. Due to the unique topography of the area, a high spatial resolution meteorological model was required, and the demonstration includes meteorology data from the archives of the Weather Research and Forecasting (WRF) model from the California and Nevada Smoke and Air Committee (CANSAC), operated by Desert Research Institute (DRI). The specific parameters for these model runs includes 1.33 km horizontal spacing and 1 hour time resolution, using only

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<sup>23</sup> “Guidance on the Preparation of Exceptional Events Demonstrations for Wildfire Events that May Influence Ozone Concentrations” (September 2016).

<sup>24</sup> See Demonstration, pp. 81-84.

<sup>25</sup> See Demonstration pp. 73-74.

the first 12 hours from each new WRF initialization.<sup>26</sup> Forward trajectories were considered between 12:00 PM PST on July 14, 2023 and 11:00 PM PST on July 15, 2023, while back trajectories were considered between 1:00 PM PST on July 14, 2023 and 2:00 PM PST on July 15, 2023.<sup>27</sup>

The 24-hour forward trajectories were launched each hour from all grid cells in the native WRF meteorological models that fell within the fire perimeters starting at half the planetary boundary level (PBL) height. Trajectories were terminated if they approached 3 meters (m) from the ground level. Several forward trajectories from all three fires indicated transport of air parcels to the Palm Springs – Fire Station monitor.<sup>28</sup> Back trajectories were launched every hour similar to the forward trajectories except for the launch height. While back trajectories are typically launched at 50 m, nighttime PBLs on July 14-July 15, 2023 were as low as 30 m for several hours. Due to confounding factors, the launch height was chosen at 15 m above the WRF grid around the Palm Springs – Fire Station monitor. Several back trajectories from the Palm Springs – Fire Station monitor and the surrounding area passed over the fires, indicating evidence of transport to the Palm Springs – Fire station monitor from the fires.<sup>29</sup>

The “Meteorology Time Series Plots at Banning and Palm Springs for July 14, 2023” indicate winds from the west at about 8 miles per hour (mph) in the hours after the start of the fires at the Palm Springs – Fire Station monitor. That day, the wind direction at the Palm Springs – Fire Station monitor shifted from the east and northeast to the northwest in the hours after the fires commenced. The “Meteorology Time Series Plots at Banning and Palm Springs for July 15, 2023” indicate light winds all day at about 5 mph at the Palm Springs – Fire Station site. On this day, a wind reversal occurred at the Palm Springs – Fire Station site from northwest in the early morning switching to the southeast, then back to northwest in the afternoon hours. These surface meteorology plots are consistent with transport from the direction of the fires on July 14, 2023, and consistent with recirculation on July 15, 2023.<sup>30</sup>

The “PM2.5 Animated Map Report” displays PM<sub>2.5</sub> concentrations in area containing the Banning and Palm Springs – Fire Station sites. This map combines data from regulatory monitors, PurpleAir sensors, and the National Oceanic and Atmospheric Administration (NOAA) National Air Quality Forecast Capability (NAQFC) PM<sub>2.5</sub> model forecast to produce an Air Quality Index (AQI) animation. The Demonstration also provides screenshots of select times to indicate elevated PM<sub>2.5</sub> in the area. The July 14, 2023 3 pm local (4 pm PST) screenshot indicates elevated PM<sub>2.5</sub> concentrations in the Banning area, with subsequent screenshots indicating progression of elevated PM<sub>2.5</sub> concentrations from the Banning area into the Coachella Valley into the morning hours of July 15, 2023.<sup>31</sup>

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<sup>26</sup> See Demonstration pp. 84-85.

<sup>27</sup> See Demonstration pp. 84-121.

<sup>28</sup> See Demonstration pp. 85-99.

<sup>29</sup> See Demonstration p. 99-121.

<sup>30</sup> See Demonstration pp. 140-144.

<sup>31</sup> See Demonstration pp. 127-131.

Hazard Mapping Systems (HMS) polygons indicate smoke densities in the atmospheric column alongside burn perimeters provided by the National Interagency Fire Center for both July 14, 2023 and July 15, 2023. The “HMS Report for July 14, 2023” indicates light smoke density at the Palm Springs – Fire Station site and around the burn perimeters.<sup>32</sup> The “HMS Report for July 15, 2023” indicates light smoke density at the Palm Springs – Fire Station site and medium to heavy density nearer to the burn perimeters.<sup>33</sup>

The “AOD Report for July 14, 2023” and “AOD Report for July 15, 2023” explore Aerosol Optical Depth (AOD) in the area of the fires and monitor. These reports show the NASA Worldview Multi-Angle Implementation of Atmospheric Correction (MAIAC) AOD at 12:30 pm PST on both days. Similar to the satellite image timing, the AOD timing on July 14, 2023 is too early in the day to show smoke impacts at the Palm Springs – Fire Station site.<sup>34</sup> On July 15, 2023, high AOD values near the fires and elevated AOD values near the Palm Springs – Fire Station site are indicated.<sup>35</sup>

Overall, the trajectory analysis, meteorological time series plots, PM<sub>2.5</sub> animated map, AOD reports, and HMS reports support that wildfire emissions were transported to the Palm Springs – Fire Station monitor from the Highland, Rabbit, and Reche fires on July 14, 2023 and July 15, 2023.

#### Evidence that the wildfire emissions affected the monitor

Analyses included in the “Interaction of Wildfire Emissions, Meteorology, and Pollutant Concentrations” and “PM<sub>2.5</sub> Animated Map Report” sections of the Demonstration provide evidence that wildfire emissions affected the Palm Springs – Fire Station monitor.

The “Interactions of Wildfire Emissions, Meteorology, and Pollutant Concentration” section provides several analyses of evidence of smoke at the monitor. Pollutant time series with wind vectors are provided for the upwind Banning monitor (located between the fires and Palm Springs), and the Palm Springs - Fire Station monitor. The Banning site experienced elevated NO<sub>x</sub>, PM<sub>2.5</sub>, and ozone on July 14, 2023, coincident with the timing of expected transport of smoke from the fires based on surface meteorology. The Palm Springs – Fire Station site subsequently experienced elevated CO, NO<sub>x</sub>, and ozone on July 14, 2023, consistent with the expected arrival time of smoke from the fires based on surface meteorology, and after observed elevated concentrations at Banning. In the early morning of July 15, 2023, a wind reversal was observed in the surface meteorology at both the Banning and Palm Springs - Fire Station sites. At the Palm Springs – Fire Station site, CO and NO<sub>x</sub> concentrations began to decline, but were still elevated through the morning of July 15, 2023, corresponding with elevated ozone occurring at sunrise.<sup>36</sup>

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<sup>32</sup> See Demonstration pp. 121-122.

<sup>33</sup> See Demonstration pp. 123-124.

<sup>34</sup> See Demonstration pp. 123-124.

<sup>35</sup> See Demonstration pp. 126-127.

<sup>36</sup> See Demonstration pp. 49-56.

The PM<sub>2.5</sub> Federal Reference Method (FRM) data at the Palm Springs – Fire Station site also provides evidence of wildfire emissions affecting the monitor on July 14, 2023. A five-year time series of seasonal (May 30 to August 29) 2019-2023 PM<sub>2.5</sub> data indicates that the July 14, 2023 concentration was the highest measured 24-hour concentration at the site in the five-year time period. While hourly data were not available at the site, since the fire emissions likely did not reach the Palm Springs – Fire Station site until the afternoon hours, it is likely that hourly concentrations would have been lower in the morning and higher once the fire emissions reached the site.<sup>37</sup> To better account for hourly PM<sub>2.5</sub> concentrations, two nearby PurpleAir sensors within 7 miles of the Palm Springs – Fire Station site provide evidence of elevated hourly PM<sub>2.5</sub> concentrations. The Movie Colony PurpleAir sensor and Cathedral Cove PurpleAir sensor indicate low PM<sub>2.5</sub> concentrations before the fires, with a sharp increase in PM<sub>2.5</sub> concentrations well above the 99<sup>th</sup> percentile of the last three years of historical data within ±45 days of the event reaching concentrations upwards of 100 ug/m<sup>3</sup> starting at 4 pm PST and 6 pm PST, respectively, and peaking overnight. On July 15, 2023, in the early morning hours, the PM<sub>2.5</sub> concentrations began to decline, though they remained above the 99<sup>th</sup> percentile until around mid-day. By the early afternoon, PM<sub>2.5</sub> began to rise again above the 99<sup>th</sup> percentile.<sup>38</sup>

Event versus non-event diurnal profiles (June through August 2019-2023) of CO at the Palm Springs – Fire Station site also indicate atypical CO with an initial rise in the late afternoon of July 14, 2023, through the overnight hours until midday on July 15, 2023, with another rise in late afternoon of July 15, 2023, well above the non-event concentrations. The Demonstration notes that CO concentrations between the evening of July 14, 2023, through the late morning and night on July 15, 2023, were the highest or second highest hourly maxima recorded in the five year June-August diurnal distribution. In addition, CO and NO<sub>x</sub> ratios comparing event versus non-event days indicate elevated levels with several hours near the 100:1 ratio line and all others above the 20:1 ratio line. Ratios of this magnitude suggest the presence of wildfire smoke at the monitor.<sup>39</sup>

The coincident increases of pollutants associated with wildfire smoke (CO, NO<sub>x</sub>, and PM<sub>2.5</sub>) and responses in ozone concentrations, analysis of PM<sub>2.5</sub> FRM and nearby PM<sub>2.5</sub> sensor data on event and non-event days, elevated and unusual CO diurnal profiles compared to historical concentrations, and high CO and NO<sub>x</sub> ratios provide evidence that wildfire emissions affected the Palm Springs – Fire Station monitor on July 14, 2023 and July 15, 2023.

#### Additional evidence that the wildfire emissions caused the ozone exceedance

The “Interaction of Wildfire Emissions, Meteorology, and Pollutants Concentrations” and “Matching Day Analysis” sections of the Demonstration includes additional evidence to support that the wildfire emissions specifically affected ozone concentrations at the exceeding Palm Springs – Fire Station site and caused the ozone exceedances.

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<sup>37</sup> See Demonstration pp. 56-57.

<sup>38</sup> See Demonstration pp. 57-59.

<sup>39</sup> See Demonstration pp. 60-61.

Analyses provided in the “Interactions of Wildfire Emissions, Meteorology, and Pollutant Concentrations” section investigate the influence of background ozone from the South Coast Air Basin on the Palm Springs – Fire Station monitor. The Demonstration notes that ozone concentrations on July 14-15, 2023, were elevated in the South Coast Air Basin, upwind of the fires and the Palm Springs – Fire Station monitor. To understand the magnitude of background ozone, distributions of 8-hour daily maximum ozone concentrations from five sites upwind from the fire and Palm Springs – Fire Station site were compared with similar daily wind directions (May 30-August 29 2019-2023). On July 14, 2023, wind patterns suggest that the Palm Springs – Fire Station site was downwind of the South Coast Air Basin and recorded the second highest concentration under this wind regime, higher than the 99<sup>th</sup> percentile of the distribution. All five of the upwind sites, however, recorded lower than their respective 99<sup>th</sup> percentiles. On July 15, 2023, the winds shifted, and the concentrations were compared against mixed wind conditions. Under this wind regime, the Palm Springs – Fire Station monitor recorded its highest concentration, well above the 99<sup>th</sup> percentile for this wind pattern, while all background sites were below their respective sites except one, which tied its 99<sup>th</sup> percentile value.<sup>40</sup>

An analysis of historical ozone concentrations and temperature at Palm Springs – Fire Station site shows weekday and weekend differences in the maximum 8-hour averaged daily concentration and average temperature between 6 am and 5 pm PST (5 year period, ±45 days of the event). The July 14, 2023 maximum 8-hour averaged daily concentration was the second highest weekday concentration measured, while the July 15, 2023 maximum 8-hour averaged daily concentration was the highest weekend concentration measured, and the only weekend exceedance.<sup>41</sup>

The “Matching Day Analysis” provides a comparison of ozone concentrations on meteorologically similar days. The Analog Forecast Model (Analogmod) compares meteorological parameters on the forecasted day with historical meteorological fields produced by the North American Mesoscale Forecast System (NAM), with the NAM field split into four distinct regions, including the South Coast Air Basin and Coachella Valley (where the Palm Springs – Fire Station is located). Five days from the historical data are identified by Analogmod as days with the most similar meteorological conditions to the forecasted day.

The results of Analogmod indicate that the predicted maximum 8-hour average on July 14, 2023, and July 15, 2023, were well below the observed maximum 8-hour average, as well as above the upper 99% confidence interval of mean absolute error. The difference between the predictions and observed, for the purposes of Analogmod, is defined as the model error. The model error for July 14, 2023, was 14.0 ppb and the model error for July 15, 2023 was 15.2 ppb. Since the observed concentration on July 14, 2023 was 93 ppb, the predicted concentration was approximately 79 ppb, below the level of the 1997 8-hour ozone NAAQS, though with an upper 99% confidence interval of the mean absolute error (June-August 2019-2023) of 8.3 ppb, indicating an error bar exceeding the level of the 1997 8-hour ozone NAAQS. Since the

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<sup>40</sup> See Demonstration pp. 49-56.

<sup>41</sup> See Demonstration pp. 62-63.

observed concentration on July 15, 2023, was 86 ppb, the predicted concentration was approximately 71 ppb and also with an error bar of 8.3 ppb, with and without the error bars these predicted concentrations were below the level of the 1997 8-hour ozone NAAQS.<sup>42</sup>

The matching day analysis provides an additional assessment of the enhancement of ozone, defined for this purpose as the difference between ozone at the Palm Springs – Fire Station and background ozone (average of five monitors upwind of the wildfires in the South Coast Air Basin). On July 14, 2023, Analogmod predicted a negative enhancement at the Palm Springs – Fire Station site, suggesting that ozone was predicted to be lower at the Palm Springs – Fire Station site by 11.6 ppb than at the average of the background stations, while the observed concentration was 0.2 ppb higher. On July 15, 2023, Analogmod also predicted a negative enhancement at the Palm Springs – Fire Station site, suggesting that ozone was predicted to be lower at the Palm Springs – Fire Station site by 15.6 ppb than at the background stations, while the observed concentration was 10.6 ppb lower.<sup>43</sup>

Taken together, the analysis investigating the influence of background ozone from the South Coast Air Basin at the Palm Springs – Fire Station monitor, the historical ozone and temperature analysis, and the matching day analysis contribute to an additional weight of evidence that wildfire emissions caused the 1997 8-hour ozone exceedances at the Palm Springs – Fire Station monitoring site.

### Conclusion

The analyses included in the Demonstration, specifically, the comparison to historical ozone concentrations, HYSPLIT forward and back trajectory analyses, unusually elevated PM<sub>2.5</sub>, CO, and NO<sub>x</sub>, CO and NO<sub>x</sub> ratios, unusual diurnal ozone profile (July 15, 2023), unusual weekend exceedance (July 15, 2023), air quality alerts and advisories, news articles, matching day analysis, and analysis of background ozone, sufficiently demonstrate a clear causal relationship between the emissions generated by Highland, Rabbit, and Reche fires and the exceedances measured at the Palm Springs – Fire Station monitoring site.

Table 3: Documentation of the Clear Causal Relationship criterion

Exceedance Date	Demonstration Citation	Quality of Evidence	Criterion Met?
July 14-15, 2023	“Interactions of Wildfire Emissions, Meteorology, and Pollutant Concentrations” (Section 11): pp. 49-71 “Historical Analyses for Rabbit, Reche, and Highland Wildfires” (Section 12): pp. 71-81 “Q/D Analysis for July 14, 2023” (Section 13): pp. 81-83 “Q/D Analysis for July 15, 2023” (Section 14): pp. 83-84 “HYSPLIT Forward Trajectories Report for July 14-15, 2023” (Section 15): pp. 84-99	Sufficient	Yes

<sup>42</sup> See Demonstration pp. 150-161.

<sup>43</sup> See Demonstration pp. 161-164.

	<p>“HYSPLIT Back Trajectories Report for July 14-15, 2023” (Section 16): pp. 99-121</p> <p>“HMS Report for July 14, 2023” (Section 17): pp. 121-122</p> <p>“Satellite Report for July 14, 2023” (Section 18): pp. 122-123</p> <p>“AOD Report for July 14, 2023” (Section 19): pp. 123-124</p> <p>“HMS Report for July 15, 2023” (Section 20): pp. 124-125</p> <p>“Satellite Report for July 15, 2023” (Section 21): pp. 125-126</p> <p>“AOD Report for July 15, 2023” (Section 22): pp. 126-127</p> <p>“PM2.5 Animated Map Report” (Section 23): pp. 127-131</p> <p>“Meteorology Time Series Plots at Banning and Palm Springs for July 14, 2023” (Section 24): pp. 132-140</p> <p>“Meteorology Time Series Plots at Banning and Palm Springs for July 15, 2023” (Section 25): pp. 140-150</p> <p>“Matching Day Analysis” (Section 26): pp. 150-164</p> <p>“Clear Causal Conclusion” (Section 27): p. 165</p>		
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**Not Reasonably Controllable or Preventable**

The Exceptional Events Rule presumes that wildfire events on wildland are not reasonably controllable or preventable [40 CFR §50.14(b)(4)]. The Demonstration provides evidence that the wildfire event meets the definition of wildfire. Specifically, the Demonstration includes maps and descriptions of the wildfires that included boundaries of protected areas as identified by the US Geographical Society (USGS) Gap Analysis Protect (GAP), to show that the majority of the wildfires took place on wildlands.<sup>44</sup> The Demonstration also notes that the cause of the wildfires is still unknown and under investigation that there is no known evidence of potential efforts that could have been performed to prevent these wildfires.<sup>45</sup> Therefore, the documentation provided sufficiently demonstrates that the event was not reasonably controllable and not reasonably preventable.

Table 4: Documentation of the Not Reasonably Controllable or Preventable criterion

Exceedance Date	Demonstration Citation	Quality of Evidence	Criterion Met?
July 14-15, 2023	<p>“Wildfire Description for Rabbit, Reche, and Highland Wildfires” (Section 8): p. 39-47</p> <p>“Not Reasonably Controllable or Preventable” (Section 19): p. 165</p>	Sufficient	Yes

<sup>44</sup> See Demonstration, pp. 39-47.

<sup>45</sup> See Demonstration, p. 165.

## Natural Event

The definition of “wildfire” at 40 CFR §50.1(n) states, “A wildfire that predominantly occurs on wildland is a natural event.” As previously described, the Demonstration includes documentation that the event meets the definition of a wildfire and occurred predominantly on wildland and therefore shows that the event was a natural event.

Table 5: Documentation of the Natural Event criterion

<b>Exceedance Date</b>	<b>Demonstration Citation</b>	<b>Quality of Evidence</b>	<b>Criterion Met?</b>
July 14-15, 2023	“Wildfire Description for Rabbit, Reche, and Highland Wildfires” (Section 8): p. 39-47	Sufficient	Yes

## Schedule and Procedural Requirements

In addition to technical demonstration requirements, 40 CFR §50.14(c) and 40 CFR §51.930 specify schedule and procedural requirements an air agency must follow to request data exclusion. Table 6 outlines the EPA’s evaluation of these requirements.

Table 6: Schedules and Procedural Criteria

	<b>Reference</b>	<b>Demonstration Citation</b>	<b>Criterion Met?</b>
Did the agency provide prompt public notification of the event?	40 CFR §50.14 (c)(1)(i)	“Public Notification During Event” (Section 9): pp. 47-49	Yes
Did the agency submit an Initial Notification of Potential Exceptional Event and flag the affected data in the EPA’s Air Quality System (AQS)?	40 CFR §50.14 (c)(2)(i)	“Regulatory Significance” (Section 6): pp. 28-29, “Appendix: Initial Notification and AMP360 Report Showing Request Exclusion Data Qualifiers Appendix” pp. 171-174	Yes
Did the initial notification and demonstration submittals meet the deadlines for data influenced by exceptional events for use in initial area designations, if applicable? Or the deadlines established by the EPA during the Initial Notification of Potential Exceptional Events process, if applicable?	40 CFR §50.14 Table 2 40 CFR §50.14 (c)(2)(i)(B)	Letter from Matthew Lakin, EPA, to Sylvia Vanderspek, EPA, R9, dated February 29, 2024. Letter from Anita Lee, EPA, to Sylvia Vanderspek, EPA, R9, dated June 27, 2024.	Yes

	<b>Reference</b>	<b>Demonstration Citation</b>	<b>Criterion Met?</b>
Was the public comment process followed and documented? <ul style="list-style-type: none"> <li>• Did the agency document that the comment period was open for a minimum of 30 days?</li> <li>• Did the agency submit to the EPA any public comments received?</li> <li>• Did the state address comments disputing or contradicting factual evidence provided in the demonstration?</li> </ul>	40 CFR §50.14 (c)(3)(v)	Letter from Michael Benjamin, CARB, to Matthew Lakin, EPA R9, dated November 9, 2024.	Yes
Has the agency met requirements regarding submission of a mitigation plan, if applicable?	40 CFR §51.930 (b)	NA	NA

**Conclusion**

The EPA has reviewed the documentation provided by CARB and prepared by South Coast AQMD to support claims that smoke from the Highland, Rabbit, and Reche wildfires in southern California caused exceedances of the 1997 8-hour ozone NAAQS at the Palms Springs – Fire Station monitoring site on July 14-15, 2023. The EPA has determined that the flagged exceedances at this monitoring site on these days satisfy the exceptional event criteria: the event was a natural event, which affected air quality in such a way that there exists a clear causal relationship between the event and the monitored exceedances, and it was not reasonably controllable or preventable. The EPA has also determined that CARB and South Coast AQMD have satisfied the schedule and procedural requirements for data exclusion.