ENCLOSURE: TECHNICAL SUPPORT DOCUMENT FOR EPA NONCONCURRENCE ON AN O_3 EXCEEDANCE MEASURED IN CLARK COUNTY, NEVADA ON JUNE 26, 2020 AS AN EXCEPTIONAL EVENT

On July 1, 2021, Clark County Department of Environment and Sustainability (CCDES) submitted an exceptional event demonstration for an exceedance of the 2015 8-hour ozone (O_3) National Ambient Air Quality Standards (NAAQS) of 0.070 parts per million (ppm) that occurred at the Paul Meyer site on June 26, 2020.[1,2] The demonstration submitted by CCDES stated that the exceedance measured on June 26, 2020 was caused by the Rock Path Fire in Utah (UT) and the Miller and Twin fires in Nevada (NV).[3] 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 only if the EPA determines that the agencies have demonstrated that the event meets the rule criteria and requirements.

As described further in this document, EPA has concluded that this event does not meet the requirements in the Exceptional Events Rule because the demonstration has not sufficiently shown a clear causal relationship between the specific event and the monitored exceedance. This conclusion was based on review of the extensive evidence presented in the demonstration, including meteorological information, fire emission information, trajectory analysis, satellite data, ground level monitoring data, analysis of meteorologically similar days, and statistical modeling analysis. The data and analyses presented in the demonstration, though extensive, do not support that wildfire emissions were transported to the Paul Meyer monitoring site and impacted air quality so as to cause an exceedance of the NAAQS. As a result, the EPA is nonconcurring on this exceptional event demonstration.

The remainder of this document summarizes the Exceptional Events Rule requirements, the event that is the subject of the submitted demonstration, the EPA's review process, and the bases for the EPA's determinations regarding the event.

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. If any one of the criteria are not met, the EPA will nonconcur with the demonstration.

[1] "Exceptional Event Demonstration for Ozone Exceedances in Clark County, Nevada – June 26, 2020," (July 2021) ("demonstration").
[2] While submitted by CCDES, the demonstration was prepared by Sonoma Technology under contract with CCDES.
[3] See demonstration, p. 1-1.

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;"

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."[4]

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 excluded from use 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

[4] 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."

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 the demonstration, a narrative conceptual model of the event that describes and 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 O_3 events, the EPA recommends that the narrative conceptual model also discuss the interaction of emissions, meteorology, and chemistry of event and non-event O_3 formation in the area, and, under 40 CFR §50.14(a)(1)(i), must describe the regulatory significance of the proposed data exclusion.

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 O_3 events, air agencies should compare the O_3 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, that the emissions from the wildfire influenced the monitored concentrations, and, in some cases, air agencies may need to provide evidence of the contribution of the wildfire's emissions to the monitored O_3 exceedance or violation.

For wildfire O_3 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.[5] 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/O_3 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/O_3 events will be considered based on Tier 3 analyses.

- Tier 1: Wildfires that clearly influence monitored O_3 exceedances or violations when they occur in an area that typically experiences lower O_3 concentrations.
    - *Key Factor*: seasonality and/or distinctive level of the monitored O_3 concentration. The event-related exceedance occurs during a time of year that typically has no exceedances, or is clearly distinguishable (*e.g.*, 5-10 parts per billion (ppb) higher) from non-event exceedances.

[5] "Guidance on the Preparation of Exceptional Events Demonstrations for Wildfire Events that May Influence Ozone Concentrations" (September 2016) ("wildfire O_3 guidance document").

- In these situations, O_3 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 O_3 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. If both key factors are met, then a Tier 2 demonstration will likely be sufficient.
  - *Key Factor 1*: fire emissions and distance of fire(s) to affected monitoring site location(s). Calculated fire emissions of nitrogen oxides (NO_x) and reactive-volatile organic compounds (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 ($Q/D \geq 100$ tpd/km). The guidance document provides additional information on the calculation of Q/D.
  - *Key Factor 2*: comparison of the event-related O_3 concentration with non-event related high O_3 concentrations. The exceedance due to the exceptional event:
    - is in the 99th or higher percentile of the five-year distribution of O_3 monitoring data, OR
    - is one of the four highest O_3 concentrations within one 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 O_3 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 O_3 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.[6]

[6] 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."

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" (emphasis added). 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 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 November 30, 2020, CCDES submitted an Initial Notification of a potential Exceptional Event for numerous exceedances of the 2015 8-hour O_3 NAAQS that occurred at monitoring sites within Clark County, Nevada during 2018 and 2020.[7] On July 1, 2021, CCDES submitted an exceptional event demonstration for one exceedance of the 2015 8-hour O_3 NAAQS that occurred at the Paul Meyer site within Clark County, Nevada on June 26, 2020.[8]

Regulatory Significance

The EPA determined that data exclusion of some of the exceedances referenced in the Initial Notification may have a regulatory significance for an attainment date extension or determination of attainment by the Marginal area attainment date for the Las Vegas nonattainment area (NAA) for the 2015 8-hour O_3 NAAQS, and worked with CCDES to identify the relevant exceedances and monitoring sites affected.[9] Table 1 summarizes the exceedance that CCDES included in the demonstration.

Table 1: 2015 8-hour O_3 NAAQS Exceedance Summary

Exceedance Date	Monitoring Site Name	AQS ID	2015 8-hour Avg. (ppm)
June 26, 2020	Paul Meyer	32-003-0043	0.073

Narrative Conceptual Model

The demonstration submitted by CCDES provided a narrative conceptual model in Section 1.4 to describe how emissions from the Rock Path Fire (UT), Miller Fire (NV), and Twin Fire (NV) wildfires may have caused the O_3 exceedance at the Paul Meyer monitoring site. Additional information addressing narrative conceptual model components was also presented in Executive Summary and Sections 2 and 3. The narrative conceptual model in Section 1.4 included a short summary describing how the observed exceedance was caused by wildfire events in southwestern Utah and southern Nevada that qualify as an exceptional event under the Exceptional Events Rule. The demonstration incorrectly identified that the exceedance at the

[7] See email from Araceli Pruett, CCDES, to multiple staff at EPA Region 9, dated November 30, 2020.
[8] See letter from Marci Henson, CCDES, to Elizabeth Adams, EPA Region 9, dated July 1, 2021.
[9] See letters from Elizabeth Adams, EPA Region 9, to Michael Sword, CCDES, dated January 26, 2021, and to Marci Henson, CCDES, dated April 26, 2021 and May 4, 2021.

Paul Meyer site could lead to an O_3 nonattainment designation for the Clark County area;[10] the portion of Clark County containing the Paul Meyer site is currently designated as the Las Vegas, NV Marginal NAA for the 2015 O_3 NAAQS. The demonstration and the conceptual model did not identify the regulatory action for which this event is significant, which is a determination whether the area attained by the Marginal area attainment date or qualifies for an attainment date extension.

Section 2 of the demonstration included non-event characteristics of Clark County, such as general descriptions of the geography, topography, and meteorology; a description of the ambient air quality monitoring network; and a summary of typical non-event O_3 formation in the Clark County area, including discussion of O_3 precursor emissions, seasonal patterns, and meteorology associated with typical exceedances.[11] Section 3 of the demonstration included the event-related characteristics. The demonstration specifically identified the Rock Path Fire (UT), Miller Fire (NV), and Twin Fire (NV) wildfires as contributing to the smoke transported to the Clark County area. The demonstration stated that these fires all started on June 25-26, 2020 and were likely all due to lightning from storms occurring in the afternoon and early evening on June 25, 2020.[12] The demonstration included Clark County perimeter maps with monitor locations; Hazard Mapping System (HMS) fire detection maps from June 23-26, 2020 showing generally localized small smoke plumes emanating from several fires outside of Clark County in Arizona, Utah, Nevada, and California; and ground imagery of reduced visibility in the Las Vegas area on June 26, 2020.[13]

The demonstration presented graphs of daily 8-hour maximum O_3 concentrations measured in 2015-2020 for the Paul Meyer monitoring site, along with hourly O_3 concentrations for all monitors in Clark County one week before and after the June 26, 2020 event.[14] Graphs of 8-hour maximum concentrations were presented as a times series plot, as well as by day of year to show seasonality.[15] These graphs showed 8-hour maximum concentrations at the 99th percentile for the Paul Meyer monitoring site on June 26, 2020. The hourly O_3 concentration plots showed an increasing period of maximum daily O_3 concentrations from June 19-22, 2020, followed by a period of slightly lower maximum concentrations on June 23-24, 2020, and then an increase on June 25 and 26, 2020. Daily maximum hourly O_3 concentrations generally decreased after the June 26 exceedance through the beginning of July.[16] The demonstration did not include any evidence that CCDES issued an air quality advisory noting that the area was being impacted by wildfire smoke or that high O_3 concentrations were expected as a result.

The demonstration stated that O_3 and O_3 precursor emissions from the fires were transported via a low pressure system centered over eastern Utah, facilitating transport from the Rock Path, Twin, and Miller fires via counterclockwise winds in the lower troposphere.[17] It also noted high O_3 concentrations in central and southern California on June 23, 2020 that generally persisted through June 26, 2020, as observed in plots of the O_3 Air Quality Index (AQI) on the EPA's

[10] See demonstration, p. ES-1.
[11] See demonstration, pp. 2-1 to 2-9.
[12] See demonstration, pp. 3-8 to 3-9.
[13] See demonstration, pp. 3-4 to 3-9, pp. 3-20 to 3-22.
[14] See demonstration, pp. 2-7 to 2-9.
[15] See demonstration, pp. 2-7 to 2-8.
[16] See demonstration, p. 2-9.
[17] See demonstration, p. 3-42.

AirNow page; the demonstration states that the plots show that high concentrations of O_3 occurred across multiple states corresponding with the presence of wildfire smoke.[18] The demonstration did not include any assessment of the particulate matter with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers ($PM_{2.5}$) AQI; $PM_{2.5}$ is a more typical indicator of wildfire smoke, and it should be noted that the areas referenced in the demonstration with high O_3 commonly experience such concentrations during O_3 season.

The demonstration information referenced above includes several analyses that were located outside of the demonstration's stated narrative conceptual model and within the detailed technical sections addressing other rule criteria. The wildfire O_3 guidance document states that narrative conceptual models are expected to "help readers and the reviewing EPA Regional office understand the event formation and the event's influence on monitored pollutant concentrations before the reader reaches the portion of the demonstration that contains the technical evidence to support the requested data exclusion."[19] The detail provided in Section 1.4 did not clearly or completely outline the conceptual model of the event formation and influence on monitored pollutant concentrations; rather, it presented the conceptual model as a summary of the clear causal relationship evidence. The conceptual model section also did not include the types of information outlined in the wildfire O_3 guidance document. Additional information that reflected the conceptual model requirements was included elsewhere in the demonstration and is described above; however, this information should have been included or specifically referenced in the conceptual model portion at the beginning of the demonstration to clearly outline the demonstration's overall characterization of how the event led to the observed exceedance.

Overall, the demonstration contained the elements required for inclusion in the conceptual model portion of the exceptional events demonstration.

Table 2: Documentation of the Narrative Conceptual Model

Exceedance Date	**Demonstration Citation**	**Quality of Evidence**	**Criterion Met?**
June 26, 2020	Executive Summary: p. ES-1 Section 1.4: pp. 1-7 to 1-8 Section 2: pp. 2-1 to 2-9 Section 3: pp. 3-3 to 3-9, 3-20 to 3-22, 3-42	Sufficient	Yes

Clear Causal Relationship

The demonstration included several analyses intended to support a clear causal relationship between the wildfire event and the monitored exceedance. These analyses are presented in Section 2.3 and Section 3 of the demonstration.

Comparison with historical concentrations

The demonstration included a comparison with historical concentrations, as required by 40 CFR §50.14(c)(3)(iv)(C). The demonstration compared the exceedance to six years of historical data (2015-2020) at the Paul Meyer monitoring site.[20] The graphs show that the 8-hour maximum concentration for the event (0.073 ppm) was at the 99th percentile value when using year-round

[18] See demonstration, pp. 3-3 to 3-4.
[19] See wildfire O_3 guidance document, p. 7.
[20] See demonstration, pp. 2-7 to 2-8, pp. 3-1 to 3-3, pp. 3-30 to 3-32.

data. When comparing to percentiles calculated using data from May through September during 2015-2019, the concentration for the event fell between the 95th and 99th percentile values (0.070 and 0.076 ppm, respectively). The historical concentration plots also show that observed concentrations at the Paul Meyer monitor were at or above 0.073 ppm ten times during the spring and summer of 2020. Some of these other exceedance dates were included in other submitted exceptional events demonstrations.

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 exceedance identified in this demonstration occurred during the regular ozone season when other exceedances similar in magnitude were measured. Therefore, the exceedance does 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

The demonstration included an evaluation of the Tier 2 Key Factors. For the Tier 2 Key Factor 1, the demonstration provided an analysis of fire emissions (Q) and distance (D) of the wildfires to the monitoring site locations.[21] The demonstration generated 24-hour back trajectories from the affected monitoring sites, establishing a buffer of 25% of the distance traveled by the trajectory to establish which wildfires the demonstration should include in the Q/D analysis. Neither the Rock Path Fire nor the Miller Fire fell within the trajectory buffer, indicating transport within the previous 24 hours from these two fires was not likely. Q was calculated from emissions on June 26, 2020 for the Twin Fire using BlueSky Playground version 3.0.1, utilizing information such as the fire's location and daily fire growth derived from agency or news reports citing official sources. The distance-weighted sum is 2.9 tpd of NO_x and VOC per km, which is well below the Tier 2 Key Factor 1 screening value of 100 tpd/km. In Appendix A, additional Q/D analyses were conducted to provide Q/D estimates for the Rock Path and Miller fires, and to give a more conservative estimate for the Twin Fire, based on fire growth through 4:00 PM Pacific Standard Time (PST) on June 26.[22] Fire growth information was obtained from the Incident Information System (InciWeb) or the Utah state fire information website. The Q/D value for the Rock Path Fire on June 25, 2020 was 0.5 tpd/km. Q/D values for the Rock Path, Miller, and Twin fires on June 26, 2020 were 0.6, 0.9, and 1.7 tpd/km, respectively. These values are also well below the screening value of 100 tpd/km, even if combined over multiple days and fires. Therefore, the event exceedance does not meet the Tier 2 Key Factor 1.

For the Tier 2 Key Factor 2, the demonstration included evidence that the exceedance is not at or above the 99th percentile from the past five years of O_3 season data (May-September, 2015-2019) or among the four highest concentrations measured at the Paul Meyer site in 2020 when including other proposed exceptional event days. The exceedance was, however, at the 99th percentile value when considering the full five years of O_3 data. Therefore, the event exceedance meets the Tier 2 Key Factor 2.

[21] See demonstration, pp. 3-23 to 3-29.
[22] See demonstration, Appendix A, pp. A.1 to A.2.

Based on the analysis of the Key Factors for Tier 2, the EPA's wildfire O_3 guidance document indicates that a Tier 3 analysis is appropriate for this event. As described below, the demonstration included analyses intended to address the required elements for a Tier 3 clear causal relationship analysis based on the EPA's wildfire O_3 guidance document. This includes evidence intended to support that (1) wildfire emissions were transported from the wildfire to the monitor; (2) wildfire emissions affected the monitor; and (3) wildfire emissions caused the O_3 exceedance(s).

Tier 3 analysis: Evidence of transport of wildfire emissions from the wildfire to the monitor
The demonstration presented analyses of trajectories using the Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) model along with HMS fire and smoke product maps, visible satellite imagery, and radar imagery. Several separate trajectory analyses were provided.[23] In the first analysis, 24-hour back trajectories were provided from an unlabeled location at latitude 36.08 degrees north and longitude 115.17 degrees west within the Las Vegas Valley with initial heights of 50, 500, and 1000 meters (m).[24] The demonstration listed the timing of trajectories in both Coordinated Universal Time (UTC) and "local time," which appears to reference PST.[25] The 24-hour backward trajectories were initialized at 1800 UTC (10:00 AM PST) on June 26, 2020 to coincide with the rapid increase in O_3 concentration and were run using High Resolution Rapid Refresh 3-km meteorological model data. The 500 m trajectory shows transport from the area near the Rock Path Fire in the hours between 000 UTC and 600 UTC on June 26, 2020 (4:00 PM PST and 10:00 PM PST on June 25, 2020), while the 500 m and 1000 m trajectories show transport from areas near the Twin Fire in the hours between 600 UTC and 1200 UTC on June 26, 2020 (10:00 PM PST on June 25, 2020 and 4:00 AM PST on June 26, 2020); the 50 m trajectory does not show transport from near any of the fires and none of the trajectories pass near the Miller Fire.

The second trajectory analysis provided a matrix of approximately 25 back trajectories initialized over the Las Vegas area at 100 m altitude and 1800 UTC (10:00 AM PST) on June 26, 2020, run using North American Mesoscale Forecast System 12-km meteorological model data.[26] The trajectory matrix shows approximately eight trajectories traveling from Utah near the Rock Path Fire to the Las Vegas area, while three trajectories appear to pass near the Nevada fires: two near both the Twin Fire and Miller Fire, and the third near only the Twin Fire. All other trajectories remain well south and east of the fires listed in the demonstration and support that air quality at 10:00AM PST on June 26, 2020 was the result of local impacts or possibly air from the Las Vegas area or nearby leaving the area on June 25, 2020 and being transported back to the city the following day.

The third trajectory analysis included HYSPLIT trajectory frequency plots.[27] The trajectory frequency plot is based on trajectories run every 3 hours for 24 hours from a single location and height; regions are shaded by the number of trajectories that pass through them. The trajectory frequency plot was run from the same location as the first analysis within the Las Vegas Valley,

[23] See demonstration, pp. 3-10 to 3-19.
[24] See demonstration, pp. 3-10 to 3-13. The location of the Paul Meyer station appears to be approximately 5 miles to the west-northwest of this latitude and longitude.
[25] In June 2020, the local time zone for Las Vegas was Pacific Daylight Time (PDT). However, for consistency with the demonstration, this TSD will use PST. The offset from PDT to PST is one hour later (*i.e.*, 12:00 PM in PST is 1:00 PM in PDT).
[26] See demonstration, p. 3-12, p. 3-14.
[27] See demonstration, pp. 3-15 to 3-16.

initiated at 100 m and 1800 UTC (10:00 AM PST) on June 26, 2020 and the 24 hours prior. The trajectory frequency plots show that while some transport did occur from regions to the north of Las Vegas in the general direction of the fire locations, a greater percentage of trajectories came from south of the Las Vegas area.

The fourth trajectory analysis provided forward trajectory matrices from the Rock Path, Twin, and Miller fires.[28] These 24-hour trajectory matrices were initiated at 300 UTC on June 26, 2020 (7:00 PM PST on June 25, 2020) at 500 m for the Rock Path Fire, 100 m for the Twin Fire, and 250 m for the Miller Fire. For the Rock Path Fire, the trajectories terminate largely to the north or east of the Las Vegas area, although they do show transport generally towards the area. Trajectories run from the Twin and Miller fires do appear to reach the Las Vegas area around 9-12 hours after the trajectories were initiated, corresponding to the early morning hours of June 26, 2020.

While overall the trajectory analysis provides some evidence of transport from some of the fires to the Las Vegas area, it is not clear that the timing of the trajectory paths coincides with significant fire activity. For instance, the forward trajectory analysis from the Miller Fire was initiated at 0300 UTC on June 26, 2020 (7:00 PM PST on June 25, 2020). As stated in the demonstration, according to InciWeb, the Miller Fire started at approximately 1:45 PM PST (2145 UTC) on June 26.[29] The demonstration provided radar imagery showing reflectivity over the area of the Miller Fire on the afternoon of June 25, 2020 and suggested that the reflectivity indicated that the fire must have started earlier than reported (*i.e.*, that the fire started in the afternoon on June 25, 2020). The demonstration stated that no storms were observed over Nevada during the day on June 26, 2020 that could have initiated a lightning-based fire. However, radar reflectivity from the same source cited in the demonstration for June 25, 2020 shows that there were also storms within approximately 40 miles of the Miller Fire on June 26, 2020 starting at approximately 1800 UTC (10:00 AM PST) and increasing or continuing for several hours.[30] The first HMS fire detection in the vicinity of the Miller Fire was at approximately 2000 UTC (12:00 PM PST) on June 26, 2020, whereas HMS fire detections were observed beginning around 2200 UTC on June 25 and 000 UTC on June 26 (2:00 PM and 4:00 PM PST on June 25) for the Rock Path Fire and Twin Fire, respectively.[31] It is therefore reasonable to conclude that the Miller Fire most likely began around mid-day on June 26, 2020, consistent with the official report, while the Miller Fire and Rock Path Fire began in the mid-afternoon on June 25, 2020. Thus, the trajectory analyses showing transport from the Miller Fire do not correspond to a time when fire was actively burning in that location, and furthermore, the Miller Fire did not begin early enough for smoke to be transported to the Las Vegas area and affect the O_3 exceedance that occurred on June 26, 2020.

For the Rock Path and Twin fires, the various HYSPLIT trajectories offer mixed evidence of transport from the fires to the Las Vegas NAA (*i.e.*, some trajectory analyses support transport while others do not). However, in cases where trajectories that reached the Las Vegas area did pass over or near the fires, these trajectories correspond to times near when the fires were ignited or within the first few hours of ignition. It is unclear whether significant smoke was being

[28] See demonstration, p. 3-15, pp. 3-17 to 3-19.
[29] See demonstration, p. 3-23; https://inciweb.nwcg.gov/incident/6809/.
[30] Data accessed from https://www.ncei.noaa.gov/maps/radar/.
[31] HMS detections are downloadable and available at https://www.ospo.noaa.gov/Products/land/hms.html#data.

produced so soon after the fires ignited. As discussed above, the Q/D analysis relied primarily on emissions from June 26, 2020, even though emissions from the identified fires would most likely have to have been released by the evening of June 25, 2020, to allow sufficient time for the emissions to be transported to and affect mid-day O_3 concentrations in the Las Vegas area on June 26, 2020. Only the Rock Path Fire was included in the calculations of Q/D for June 25, 2020; the Twin Fire emissions provided for June 26, 2020 included all area burned through approximately 4:00 PM PST and overestimated the potential contributions from the fire based on transport from the evening of June 25, 2020. The total emissions from both fires over June 25-26, 2020 amount to less than 400 tons of reactive VOCs (approximately 600 tons of total VOCs) and less than 120 tons of NO_x; these values are larger than, but on the same order of magnitude as, total daily emissions of NO_x and VOCs within the Las Vegas area based on 2017 emission inventories.[32] Given that the smoke emissions from these fires were relatively low and only a small fraction of the emissions listed occurred during periods where there was evidence of any transport to Las Vegas, it is unlikely that NO_x and VOCs could have been transported from these fires in quantities large enough to significantly perturb O_3 concentrations in the Las Vegas area. Notably, the daily HMS smoke contours included in the demonstration only show the presence of smoke from the Rock Path Fire on June 26, 2020; no smoke plumes were detected from the other fires on either June 25 or June 26, 2020.[33] This further suggests that smoke generation from these fires was inadequate to reach the Las Vegas area in quantities large enough to affect local O_3 concentrations on June 26, 2020.

In addition to the HYSPLIT trajectories, the demonstration provided analyses of satellite data. The HMS smoke plumes, as discussed above, only show smoke emanating from the Rock Path Fire on June 26, 2020; no smoke plumes are visible from the other fires discussed in the demonstration. (Though there are other smoke plumes on the map from fires that were not included in the demonstration, those plumes remain far from the Las Vegas area except on June 23, 2020, which was too early to impact O_3 concentrations on June 26, 2020.)[34] The Rock Path Fire smoke plume on June 26, 2020 extends from the fire to the northeast, away from Las Vegas, indicating primary transport of smoke from that fire in the opposite direction of Las Vegas. The demonstration also included visible satellite images in which no obvious smoke plumes are visible from any of the three fires;[35] on June 26 there may be some smoke shown near the Rock Path Fire to the north/northeast. The images show only light cloud cover (with no distinguishable smoke) over the Las Vegas NAA on June 25, and no visible smoke or cloud cover over the area on June 26. The demonstration also provided satellite retrievals of aerosol optical depth (AOD), carbon monoxide (CO), and nitrogen dioxide (NO_2). The AOD images did not provide any conclusive evidence in support of the demonstration because they did not show increases in AOD over the fires or the Las Vegas area.[36] While the concentrations of CO and NO_2 were shown to be elevated over the fire locations, the plumes do not show elevated concentrations over Las Vegas on June 26, 2020 or any of the days preceding the exceedance day;[37] therefore,

[32] See demonstration, p. 2-6, Appendix A, pp. A-1 to A-2.
[33] See demonstration, p. 3-6.
[34] See demonstration, pp. 3-4 to 3-6.
[35] See demonstration, pp. 3-6 to 3-7.
[36] See demonstration, Appendix B, pp. B.1 to B.3.
[37] See demonstration, pp. 3-32 to 3-35.

the satellite observations also do not provide evidence of transport from the fires to the Las Vegas area.

The demonstration also provided media reports of smoke being emitted in the vicinity of the wildfires, although no references were made to smoke in the Las Vegas area.[38] The demonstration also included visibility images taken on June 26, 2020 that show slight haze in the Las Vegas area, though the haze could have other sources besides smoke, including smog caused by local urban O_3 production.[39] Surface imagery showing limited visibility impairment is not indicative of smoke without the presence of O_3 precursors and more specifically, smoke-emitted pollutants such as particulate matter, CO, organic carbon (OC) or levoglucosan, which are further discussed in the following section of this TSD. The media reports and visibility images were intended to support that the smoke that was transported to the area as indicated by satellite data actually reached the ground; however, neither the satellite data nor the evidence presented for ground impacts show evidence of smoke reaching the Las Vegas area or impacting air quality at ground level.

Several meteorological analyses were included in the demonstration.[40] Surface frontal and upper air maps show that a low-pressure system over the California-Arizona border accompanied by a surface stationary front and upper-level trough was present on June 26, 2020. Skew-T diagrams provided for Las Vegas demonstrate that the atmosphere was very dry on June 26 with surface temperatures over 40 degrees Celsius. There was a surface inversion present at the 1200 UTC (4:00 AM PST) sounding on June 26, which was overrun by the 000 UTC sounding on June 27 (4:00 PM PST on June 26). Measured winds from the 1200 UTC (4:00 AM PST) sounding on June 26 demonstrate that winds were light and variable in the lower portions of the atmosphere. Measured winds at the 000 UTC sounding on June 27 (4:00 PM PST on June 26) were light and from the northwest in the lower portions of the atmosphere. The meteorological data supports that the atmospheric conditions were favorable to vertical mixing but does not provide coincident evidence that smoke was being transported to the Las Vegas area to be mixed down to ground level. The meteorological data also supports that conditions were favorable for local O_3 production in the Las Vegas NAA.

Overall, the trajectory analysis, satellite imagery, and evidence of smoke reaching the ground are inadequate to demonstrate that smoke was transported to the Las Vegas area and to the Paul Meyer monitoring station.

<u>Tier 3 analysis: Evidence that the wildfire emissions affected the monitor</u>
The demonstration presented an analysis of ambient monitoring data of O_3, precursors, and pollutants associated with smoke as evidence intended to show that smoke affected the Paul Meyer monitoring station. This analysis included diurnal profiles of O_3, NO_2, $PM_{2.5}$, total nonmethane organic compounds (TNMOC) and CO from all monitors with available data in the Clark County area on June 19 through July 3, 2020.[41] The demonstration also included diurnal profiles of O_3, $PM_{2.5}$, and the ratio of particulate matter with an aerodynamic diameter less than or equal to a nominal 10 micrometers (PM_{10}) to $PM_{2.5}$ at the Paul Meyer monitoring station, and

[38] See demonstration, pp. 3-20 to 3-21.
[39] See demonstration, pp. 3-21 to 3-22.
[40] See demonstration, pp. 3-42 to 3-47.
[41] See demonstration, pp. 3-35 to 3-37.

O_3 and CO at the nearby Green Valley monitoring station on June 25-28, 2020, along with the seasonal 5th and 95th historical percentile concentrations and the seasonal average concentration of the respective pollutants for each hour.[42]

The analysis in the demonstration points to a peak in $PM_{2.5}$ concentrations at Paul Meyer late on June 25 through mid-day June 26, 2020 as evidence of smoke impacts at the monitor.[43] The peak includes several hourly concentrations that were above the 95th percentile value of $PM_{2.5}$ concentrations. The plot of all monitoring data appears to show peaks in $PM_{2.5}$ concentrations across multiple monitors in Clark County around the same time. Particulates in wildfire smoke typically present largely as $PM_{2.5}$, with relatively small amounts of particulate mass in larger fractions. The demonstration assessed the ratio of PM_{10} to $PM_{2.5}$ during this same period and concluded that the ratio was elevated relative to typical local $PM_{2.5}$ and PM_{10} levels, suggesting a higher than usual fraction of dust in the particulate composition.[44] The demonstration argued that the increase in ratio was the result of wildfire smoke mixing with dust from source regions within the transport footprint and being transported to the Las Vegas area. However, absent analyses identifying dust sources along the transport paths, and a demonstration that this dust was transported along with the smoke to the Paul Meyer monitor, the relatively high PM_{10} to $PM_{2.5}$ ratio instead suggests that the elevated peaks in $PM_{2.5}$ were not associated with smoke and instead were the result of increased contributions from local or regional dust relative to normal particulate composition. The elevated $PM_{2.5}$ concentrations therefore do not support that smoke impacted the monitors as the evidence supports that elevated concentrations of dust may have primarily increased PM_{10} concentrations but also resulted in the observed elevated $PM_{2.5}$.

The analysis also pointed to daytime CO concentrations measured at the Green Valley monitoring site that were "abnormally high compared to the expected diurnal trend" and approached the 95th percentile value of concentrations for two hours on June 26th as evidence that smoke impacted the monitors.[45] However, similar CO concentrations were observed the day prior during the same time of day, during which there was no other evidence of smoke impacts; this suggests that the concentrations observed during mid-day were typical for that time period and time of day and did not indicate impacts from wildfire smoke as opposed to impacts from a local source or meteorological effects on concentrations. The demonstration also stated that NO_x and ratios of organic carbon (OC) to elemental carbon (EC) were inconclusive regarding impacts of wildfire smoke in the Las Vegas area.[46] Similarly, no peak in TNMOC was observed during the exceedance day at the times during which the demonstration claims were impacted by smoke.[47] The analyses of $PM_{2.5}$, CO, NO_x, TNMOC, and OC/EC ratio therefore do not support that wildfire emissions affected the monitors at the Paul Meyer monitoring station.

Levoglucosan is a tracer that is commonly indicative of emissions from wood smoke and fires. The demonstration presented the concentration of levoglucosan from a filter collected at the Jerome Mack site in the Las Vegas area.[48] The analysis compared the concentration of levoglucosan measured on June 26, 2020 (11 nanograms per cubic meter, or ng/m^3) to the

[42] See demonstration, pp. 3-37 to 3-40.
[43] See demonstration, pp. 3-37 to 3-38.
[44] See demonstration, pp. 3-38 to 3-39.
[45] See demonstration, p. 3-39.
[46] See demonstration, p. 3-40, Appendix C, pp. C.1 to C.3.
[47] See demonstration, p. 3-37.
[48] See demonstration, pp. 3-40 to 3-41.

average concentration measured on selected "background" days (2 ng/m^3 with a standard deviation of 3 ng/m^3) and concluded that the concentration measured on June 26, 2020 was elevated compared to the normal range of levoglucosan concentrations.

The raw levoglucosan data from 2018-2020 was provided by CCDES to the EPA on request.[49] The EPA more closely reviewed the data treated as background concentrations in the demonstration analysis. Of the 18[50] filter dates used to calculate the background average concentration of levoglucosan for the primary monitor at the Jerome Mack site, 12 had a reported concentration of 0 ng/m^3 because levoglucosan was not detected. The remaining background concentrations ranged from 2.09 ng/m^3 to 11.18 ng/m^3. Interpretation of the mean value of this dataset is difficult because the concentrations do not follow a normal distribution. The levoglucosan concentration measured on June 26, 2020 at Jerome Mack falls within the range of concentrations measured on background days; one of the 18 concentrations on days identified as "background" days was higher than the concentration measured on June 26, 2020. The collocated sampler at Jerome Mack recorded a concentration of 5.83 ng/m^3 on June 26, 2020 compared to the 10.48 ng/m^3 concentration measured by the primary sampler, indicating a high range of uncertainty in this measurement even at the same site and that actual concentrations at the site may have been lower.

Raw levoglucosan concentrations for the Sunrise Acres site were also available for June 26, 2020 in the data provided by CCDES, though an analysis for data from this site was not included in the demonstration. Of the 19 filter dates used to calculate the background average concentration of levoglucosan at Sunrise Acres, 8 had a background concentration of 0 ng/m^3 as levoglucosan was not detected. The remaining concentrations in the background dataset ranged from 2.69 ng/m^3 to 18.86 ng/m^3, and all but two of these concentrations exceeded 6 ng/m^3. The levoglucosan concentration measured on June 26, 2020 at Sunrise Acres (11.73 ng/m^3) similarly falls within the range of concentrations measured on background days; one of the 19 concentrations on days identified as "background" days was higher than the concentration measured on June 26, 2020. The levoglucosan concentrations available from both sites on June 26, 2020 therefore fall within the range of normal, non-event concentrations and do not support that wildfire smoke impacted monitors in the Las Vegas area on June 26, 2020.

Overall, the profiles and analysis of TNMOC, CO, NO_2, OC/EC ratios, and levoglucosan concentrations, which all failed to show significant enhancement in ground level concentrations above the ranges associated with typical, non-event concentrations in the Las Vegas area, along with $PM_{2.5}$ and PM_{10} data showing that elevated $PM_{2.5}$ concentrations were likely due to dust impacts, do not support the conclusion that wildfire emissions reached ground level and impacted the exceeding monitor.

<u>Tier 3 analysis: Additional evidence that the wildfire emissions caused the O_3 exceedance</u>
The demonstration included additional evidence intended to support the conclusion that the wildfire emissions specifically affected O_3 concentrations at the exceeding Paul Meyer monitor and caused the O_3 exceedance, including matching day analysis and Generalized Additive Model

[49] *20210720_LVG_Data_2018-2020.xlsx*
[50] The demonstration states that data from 19 dates were used to calculate the background concentration (see p. 3-41); however, in the file provided by CCDES with the raw data (*20210720_LVG_Data_2018-2020.xlsx)*, only 18 dates were labeled as background dates with reported values for the Jerome Mack site.

(GAM) statistical modeling as further evidence that the O_3 concentrations were not explained by normal meteorology and emissions in the Las Vegas area.

The demonstration included an analysis of data from days that were meteorologically similar to the exceedance day.[51] The demonstration identified that on June 26, 2020, maximum temperature was in the 65th percentile, mixing layer mixing ratio was in the 64th percentile, and average wind speed was in the 41st percentile, as compared to the 30-day period surrounding June 26 over a seven-year period.[52] Matching dates were selected based on synoptic and local meteorological conditions. HYSPLIT trajectories were used to cluster dates with similar transport patterns, and then meteorological parameters were used to determine the best matching dates among those in the same cluster. The parameters included daily average wind speed, resultant wind direction and speed, geopotential height, relative humidity, and temperature at 1000 millibars (mb) and 500 mb and daily average atmospheric pressure, maximum temperature, and minimum temperature at the surface. The subset of candidate matching days was further filtered by comparing to meteorological maps at the surface and 500 mb, as well as local meteorological data. The formal analysis only considered the daily statistics, instead of evaluating, for example, wind speeds during peak O_3 hours. A selection of seven days was provided in the demonstration.[53] The days selected had O_3 concentrations ranging from 51 to 67 ppb at the Paul Meyer monitoring site. The demonstration generally found that concentrations on the identified matching days were below the level of the NAAQS and below the concentration measured on the event day of June 26, 2020.

The matching day analysis did not consider several factors in selecting similar days for comparison, such as ambient NO_x concentrations, weekday/weekend effects, O_3 concentrations on the preceding days, and evaluation of timing of wind speeds in the context of O_3 formation. For example, O_3 can build up gradually over several days; wind speeds in the late morning and early afternoon hours, when O_3 production is typically highest, may factor more strongly into the determination of daily maximum 8-hour average concentrations of O_3. The effects of these potential factors were not discussed, weakening the conclusions drawn in the matching day analysis. Additionally, of the seven matching days selected, four of the days had measured concentrations above 62 ppb, suggesting that even if the matching days themselves did not measure exceedances, the conditions observed were favorable to elevated O_3 concentrations, and small differences in meteorology or emissions between the event day and the selected matching days could be responsible for the higher O_3 values observed on the event day.

While the demonstration did compare the exceedance day to other meteorologically similar days, it did not perform a comprehensive analysis of how the exceedance day compared to other, regular non-event exceedance days to identify any clear differences. The selected dates also largely came from time periods later in the year (*e.g.*, July through September) when local biogenic VOC emissions may not be similar to those that occurred on June 26, 2020. As noted in the percentile rank analysis, the event day had relatively higher temperatures and lower wind speeds for the time of year, conditions conducive to local O_3 formation. The matching day analysis presented in the demonstration does not show that conditions on the event day were notably different than conditions that led to elevated O_3 concentrations and non-event

[51] See demonstration, pp. 3-48 to 3-52.
[52] See demonstration, p. 3-51.
[53] See demonstration, p. 3-50, p. 3-52.

exceedances, nor that the event day meteorology in the presence of normal area emissions alone was insufficient to cause the measured exceedance on the event day. The demonstration referred to a matching day analysis included as part of an addendum to an exceptional event demonstration submitted by the Arizona Department of Environmental Quality (ADEQ) that was concurred on by the EPA, and stated that the analysis presented in this demonstration is an expansion of that type of work;[54] however, unlike the demonstration reviewed here, the referenced ADEQ demonstration addendum included a more extensive analysis, including a comprehensive review of exceedance days and associated meteorology and day-of-week effects to show how the event day was unusual in comparison.[55]

To further address the claim that wildfire emissions caused the O_3 exceedance, the demonstration included information on and analysis of output from a GAM analysis that was developed for monitors in the Las Vegas area.[56] GAMs are statistical models intended to allow for prediction of a response (in this case, maximum daily 8-hour O_3 concentrations) based on linear and non-linear effects from multiple input variables. The GAM described in the demonstration used 16 separate input variables, primarily meteorological in nature, to predict O_3 concentrations each day at eight monitors in the Las Vegas area.

The demonstration provided several analyses to evaluate the GAM performance. An analysis of GAM residuals (*i.e.*, the difference between the observed concentration and the predicted concentration) found that residuals were close to zero (less than 0.5 ppb) when averaged across the dataset, and similarly when considering all days that were not flagged as exceptional events.[57] The flagged day residuals were larger; average residuals across all 2018 and 2020 flagged days ranged between 6-9 ppb for the five sites within the Las Vegas NAA, and were higher (over 12 ppb) for the sites within Clark County and operated by CCDES but outside of the NAA.[58] Values for sites outside of the NAA were based on a much smaller number of dates (2-4 as opposed to 11-22) as the monitors outside of the NAA did not exceed on most of the flagged days. As demonstrated by the R^2 values ranging from 0.55 to 0.61 for the various sites, the data presented show that there is a large amount of variability in concentrations that remains after considering the variables selected.

The wildfire O_3 guidance document states: "Users of regression models should consider the uncertainties in the model's prediction abilities, specifically at high concentrations, before making conclusions based on the modeled results. A key question when considering model uncertainty is whether the model predicts O_3 both higher and lower than monitored values at high concentrations (above 65 or 70 ppb) or whether the model displays systematic bias on these high monitored days."[59] The analysis included in the demonstration attempts to address this

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[54] See demonstration, p. 3-50.
[55] "Addendum to: State of Arizona Exceptional Event Documentation for Wildfire-Caused Exceedances on June 20, 2015 in the Maricopa Nonattainment Area – September 2016; Additional Evidence that Ozone and Ozone Precursor Emissions From the Lake Fire Reached and Affected Ozone Monitors Within the Maricopa Nonattainment Area" (May 2018), pp. 21-28.
[56] See demonstration, pp. 3-53 to 3-72.
[57] See demonstration, p. 3-58.
[58] Of the sites included in the GAM analysis, the sites that fall within the Las Vegas NAA boundaries are Green Valley, Jerome Mack, Joe Neal, Paul Meyer, and Walter Johnson. The GAM analysis also included three sites (Jean, Indian Springs, and Boulder City) which are operated by CCDES and fall outside of the NAA boundaries but are still within Clark County, and are located to the southwest, northwest, and southeast of the NAA, respectively. Refer to p. 2-3 of the demonstration for a map showing the relative locations of the monitors.
[59] See wildfire O_3 guidance document, p. 28.

concern. The demonstration included a calculation of the average residual of points not flagged as exceptional events with measured concentrations at or above 60 ppb. The average residuals of these higher concentration points were higher the averages of all residuals and of the non-flagged day residuals, in the range of 3-5 ppb for all sites. This suggests that at least some of the 6-9 ppb average residuals reported for the flagged dates at the Las Vegas NAA sites can be explained by the performance of the statistical model at high concentrations, since the flagged dates are typically among the highest concentrations measured. This is common in regression models, as implied by the text in the wildfire O_3 guidance document; points considered for exceptional events demonstrations are typically among the highest observed concentrations at the monitor, and selecting points with high observed concentrations, whether exceptional events or not, will not result in a selection that is normally distributed around the mean of the regression model. Therefore, a positive residual is expected for data with high observed concentrations, even considering the typical performance of the model. In other words, the positive residual is not itself indicative of an unusual source of O_3 affecting the monitors.

The demonstration also included a case study analysis of days not flagged as exceptional events where most monitors measured concentrations above 60 ppb, to evaluate the model performance at higher concentrations.[60] The median residuals across all monitors for each case study day ranged from 0.24 ppb to 3.89 ppb. The demonstration also gave the range (minimum and maximum) of residuals for individual monitors on each case study day. On every case study day, the highest residual for an individual monitor was between 3 ppb and 7 ppb. This further supports that a positive residual of several ppb is common for any individual monitor on higher O_3 days outside of any potential exceptional event impact. In addition, on the case study days selected, the highest concentration measured by any monitor was 72 ppb; residuals might be higher on days that measured higher concentrations.

In order to account for the normal variability inherent in the statistical model, the wildfire O_3 guidance document states that the proper calculation to estimate the contribution from an atypical source of O_3 is to compare the sum of the predicted O_3 concentration and the 95th percentile of the residuals for the model to the observed concentration, rather than the direct comparison of the predicted O_3 concentration to the observation.[61] The demonstration presented a calculation using both the 95th percentile and the 75th percentile values of the residuals.[62] Using the 95th percentile value for the residuals as described in the wildfire O_3 guidance document, a potential fire contribution of 2 ppb for Paul Meyer was found. When this potential fire contribution is subtracted from the observed concentration, the concentration at Paul Meyer on June 26, 2020 is still above the level of the NAAQS (71 ppb). Therefore, the model does not support that an unusual O_3 source affected the Paul Meyer monitoring site on June 26, 2020 sufficiently to cause an exceedance of the NAAQS; even if wildfire impacts resulted in the fire contribution listed above, the Paul Meyer monitoring site still would have exceeded the NAAQS. While the demonstration includes a similar analysis using the 75th percentile values and concludes that the concentration is sufficiently outside this narrower range of normal to have caused the exceedance, this does not meet the criteria described in the wildfire O_3 guidance

[60] See demonstration, p. 3-61.
[61] See wildfire O_3 guidance document, p. 28.
[62] See demonstration, p. 3-71.

document, which is appropriately conservative to distinguish between potential wildfire impact and the inherent variability and potential bias in the regression model.

Overall, the results from the matching day analysis and the GAM model analysis do not support that an unusual source, such as a fire, caused the O_3 exceedance measured at the Paul Meyer monitoring site in the Las Vegas NAA on June 26, 2020.

Conclusion regarding the clear causal relationship criterion

The analyses included in the demonstration do not sufficiently demonstrate a clear causal relationship between the emissions generated by Miller, Rock Path, and Twin fires and the exceedance measured at the Paul Meyer monitoring station. Specifically, the evidence presented to show transport (*i.e.*, HMS fire and smoke maps, HYSPLIT analysis, meteorological conditions, satellite imagery, and media reports of smoke), smoke impacts at the monitors (*i.e.*, O_3, precursor, and other smoke pollutant concentrations including $PM_{2.5}$, $PM_{10}/PM_{2.5}$, CO, NO_2, OC/EC, and levoglucosan), and quantification of smoke impacts (*i.e.*, matching day analysis and GAM modeling results) are inadequate to demonstrate a clear causal relationship between the emissions generated by the Rock Path Fire in Utah and the Miller and Twin fires in Nevada and the exceedance measured at the Paul Meyer monitoring station. Meteorological conditions during the period leading up to and including the exceedance were favorable to local O_3 production due to typical sources in the Las Vegas area; the demonstration did not present sufficient evidence to establish that the named wildfires were the cause of the observed exceedance on June 26, 2020.

Table 3: Documentation of the Clear Causal Relationship criterion

Exceedance Date	**Demonstration Citation**	**Quality of Evidence**	**Criterion Met?**
June 26, 2020	Section 2.3: pp. 2-6 to 2-9 Section 3: pp. 3-1 to 3-74 Appendices A-G	Insufficient	No

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 provided evidence that the wildfire event meets the definition of wildfire [40 CFR §50.1(n)]. Specifically, the demonstration included evidence that the Miller, Rock Path, and Twin Fires were wildfires (caused by lightning or unknown causes) that burned predominantly on wildland.[63] Therefore, the documentation sufficiently demonstrates that the wildfire 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?**
June 26, 2020	Section 4: p. 4-1 Section 5: p. 5-1	Sufficient	Yes

[63] See demonstration, p. 4-1.

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 included documentation that the event meets the definition of a wildfire and occurred predominantly on wildland and has therefore shown that the event was a natural event.

Table 5: Documentation of the Natural Event criterion

Exceedance Date	Demonstration Citation	Quality of Evidence	Criterion Met?
June 26, 2020	Section 4: p 4-1	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

	Reference	Demonstration Citation	Criterion Met?
Did the agency provide prompt public notification of the event?	40 CFR §50.14 (c)(1)(i)	August 11, 2021 Letter; Addendum to "Exceptional Event Demonstration for Ozone Exceedances in Clark County, Nevada – June 26, 2020"[64]	No. Notifications were for seasonal elevated levels of O_3, but not specific to this event date or type.
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)	November 30, 2020 email[65]	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)	July 1, 2021 Letter[66]	Yes
Was the public comment process followed and documented? • Did the agency document that the comment period was open for a minimum of 30 days?	40 CFR §50.14 (c)(3)(v)	August 11, 2021 Letter;[67] Appendix H, "Documentation of Public Comment Process June 26,	Yes

[64] Letter from Marci Henson, CCDES, to Elizabeth Adams, EPA Region 9, dated August 11, 2021.
[65] Email from Araceli Pruett, CCDES, to multiple staff at EPA Region 9, dated November 30, 2020.
[66] Letter from Marci Henson, CCDES, to Elizabeth Adams, EPA Region 9, dated July 1, 2021.
[67] Letter from Marci Henson, CCDES, to Elizabeth Adams, EPA Region 9, dated August 11, 2021.

	Reference	Demonstration Citation	Criterion Met?
• Did the agency submit to the EPA any public comments received? • Did the state address comments disputing or contradicting factual evidence provided in the demonstration?		2020 Demonstration"	
Has the agency met requirements regarding submission of a mitigation plan, if applicable?	40 CFR §51.930 (b)	October 22, 2018 Letter,[68] December 17, 2018 Letter[69]	Yes

Conclusion

The EPA has reviewed the documentation provided by CCDES to support claims that smoke from the Miller and Twin fires in Nevada and the Rock Path Fire in Utah caused an exceedance of the 2015 8-hour O_3 NAAQS at the Paul Meyer monitoring site on June 26, 2020. The EPA has determined that the flagged exceedance at this monitoring site on this day does not satisfy the exceptional event criteria. Specifically, although the demonstration presented evidence that these wildfires occurred on wildland in Nevada and Utah and therefore meet the requirements that the event be not reasonably controllable or preventable and a natural event, the demonstration failed to show that there exists a clear causal relationship between the event and the monitored exceedance. This conclusion was based on the review of the evidence presented in the demonstration, including meteorological information, fire emission information, HYSPLIT trajectories, satellite data, ground level monitoring data, analysis of meteorologically similar days, and statistical modeling analysis. The exceedance day experienced conditions favorable to local O_3 production within the normal summer O_3 season; the data and analyses presented in the demonstration do not support that wildfire emissions were transported to the Las Vegas NAA and caused a monitored exceedance of the NAAQS at the Paul Meyer monitoring site. As the demonstration failed to show that there exists a clear causal relationship between the wildfire event and the June 26, 2020 monitored exceedance at the Paul Meyer O_3 monitoring site in the Las Vegas NAA, EPA is nonconcurring on this exceptional events demonstration.

[68] Letter from Mike Sword, CCDES, to Elizabeth Adams, EPA Region 9, dated October 22, 2018.
[69] Letter from Elizabeth Adams, EPA Region 9, to Mike Sword, CCDES, dated December 17, 2018.