
**Review of Evidence Regarding
Claimed Exceptional Events
Leading to 24-hour PM_{2.5}
Exceedances**

Plumas County, CA

- July 8, 2007
-

US Environmental Protection Agency
Region 9

March 11, 2010

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1.0 Introduction

On March 22, 2007, EPA adopted a final rule, *Treatment of Data Influenced by Exceptional Events*¹ (EER) to govern the review and handling of certain air quality monitoring data for which the normal planning and regulatory processes are not appropriate. Under the rule, EPA may exclude data from use in determinations of National Ambient Air Quality Standard (NAAQS) exceedances and violations if a state demonstrates that an “exceptional event” caused the exceedances. Before EPA can exclude data from these regulatory determinations, the state must flag the data in EPA’s Air Quality System (AQS) database and, after notice and opportunity for public comment, submit a demonstration to justify the exclusion. After considering the weight of evidence provided in the demonstration, EPA decides whether or not to concur with each flag.

On June 17, 2009, California’s Air Resources Board (CARB) submitted a preliminary demonstration for a high-PM_{2.5} event that occurred at the Plumas County Portola monitor on July 8, 2007. Additional clarification was submitted to EPA via email on December 22, 2009.

This document sets forth the legal and factual basis for EPA’s decision regarding the specific wildfire-related event that allegedly caused an exceedance of the 24-hour PM_{2.5} standard at the Plumas County Portola monitor on July 8, 2007.

2.0 Summary of the Event

On July 5, 2007, a series of dry thunderstorms moved through Plumas National Forest in Northern California. Lightning strikes ignited over a dozen fires, collectively referred to as the Antelope Complex Fire (also called the Antelope/Wheeler Fire). The Antelope Complex Fire was contained on July 11, 2007 after burning more than 23,000 acres².

The Northern Sierra Air District and CARB operate air monitors in and around Plumas County. On July 8, 2007, the PM_{2.5} monitor at Portola recorded an exceedance of the 24-hour PM_{2.5} standard (see Table 1). CARB flagged the July 8, 2007 exceedance and requested the event be excluded as an exceptional event due to impacts from the nearby Antelope Complex Fire.

Date	Monitor	PM _{2.5} (µg/m ³)
July 8, 2007	Portola Monitor (06-063-1009-07), Plumas County	41.0

3.0 Requirements of the Exceptional Events Rule

Pursuant to 40 CFR §50.14(c)(3) (iii) a request for EPA’s concurrence on an exceptional event flag must be accompanied by a demonstration that:

¹ 13560 Federal Register / Vol. 72, No. 55 / Thursday, March 22, 2007 / Rules and Regulations.

²

http://gis.fs.fed.us/r5/hfqlg/monitoring/resource_reports/fire_and_smoke/antelopecomplex_Final_20071204.pdf. “Fire Behavior and Effects Relating to Suppression, Fuel Treatments, and Protected Areas on the Antelope Complex Wheeler Fire,” U.S Forest Service Pacific Southwest Region, p. 5. Retrieved February 6, 2010.

- (A) The event satisfies all of the criteria set forth in 40 CFR §50.1(j). It:
- affects air quality;
 - is not reasonably controllable or preventable; and
 - is caused by human activity that is unlikely to recur at a particular location, or is a natural event;
- (B) There is a clear causal relationship between the measurement under consideration and the event that is claimed to have affected the air quality in the area;
- (C) The event is associated with a measured concentration in excess of normal historical fluctuations, including background; and
- (D) There would have been no exceedance or violation but for the event.

The EER also has procedural requirements. 40 CFR §50.14(c)(2)(iii) requires that data claimed to be due to an exceptional event be flagged in the AQS database, and that an initial description of the event be provided to EPA; both must occur by July 1 of the year following the event. In addition, 40 CFR §50.14(c)(3)(i) requires that the State:

- submit a demonstration to EPA within three years of the calendar quarter of the event or 12 months prior to an EPA regulatory decision;
- provide notice and opportunity for public comment; and
- submit any public comments along with the demonstration.

The following sections evaluate CARB's demonstration for the day in question with respect to these requirements.

4.0 Criteria Set Forth in 40 CFR §50.1(j)

4.1 Affects Air Quality

As stated in the preamble to the EER, the event in question is considered to have affected air quality if it can be shown that there is a clear causal relationship between the monitored exceedance and the event, and that the event is associated with a measured concentration in excess of normal historical fluctuations.³ These criteria are discussed in detail in sections five and six below.

According to a July 6, 2007 U.S. Forest Service news release, the Antelope Complex Fire was ignited by a series of lightning strikes on July 5, 2007. The lightning strikes started over a dozen fires (collectively referred to as the Antelope Complex Fire) in the Plumas National Forest, the largest of which was the Wheeler Fire, near Wheeler Peak.⁴ The Antelope Complex Fire was contained on July 11 after burning more than 23,000 acres.⁵

³ See 72 FR 13569, 72 FR 49051, and 73 FR 14702.

⁴ June Natural Events Documentation (NED), Attachment 3.

⁵

http://gis.fs.fed.us/r5/hfqlg/monitoring/resource_reports/fire_and_smoke/antelopecomplex_Final_20071204.pdf. "Fire Behavior and Effects Relating to Suppression, Fuel Treatments, and Protected Areas on the Antelope Complex Wheeler Fire," U.S Forest Service Pacific Southwest Region, p. 5. Retrieved February 6, 2010.

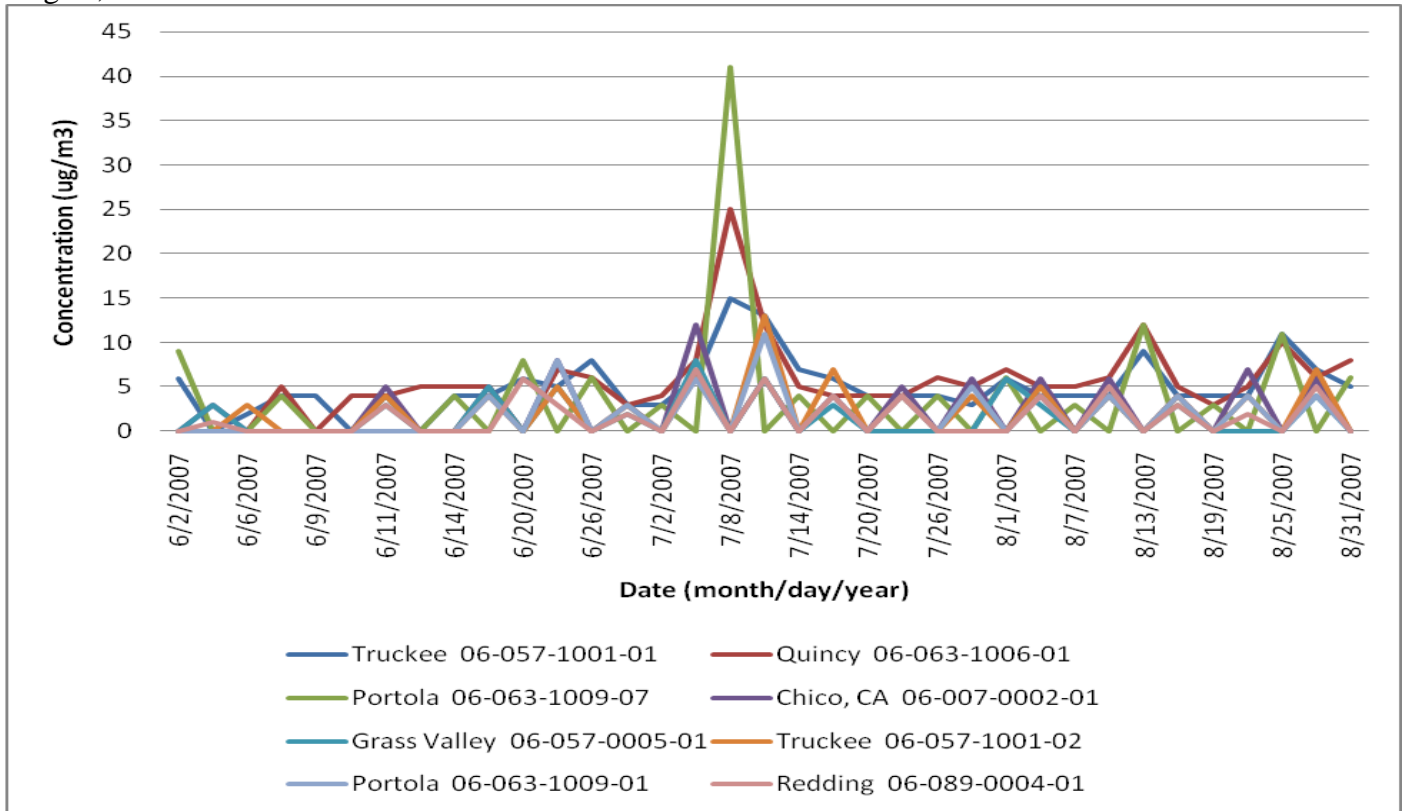
Figure 1 shows the Federal Reference Method (FRM) PM_{2.5} monitors surrounding the Antelope Complex Fire. Portola and Quincy operate in Plumas County, just southwest and south of the fire. Shasta and Lassen counties lie to the north of Plumas County. In 2007, the Redding monitor was the only Federal Reference Method or Federal Equivalent Method (FEM) PM_{2.5} monitor operating in Shasta and Lassen Counties. The Chico, Butte County monitor lies to the west of Plumas County, while Grass Valley and Truckee are to the south in Nevada County.

Figure 1: Federal Reference Method PM_{2.5} monitors near the Antelope Complex Fire.



As shown in Figure 2, all three monitors that measured concentrations on July 8, 2007 (Portola Parameter Occurrence Code (POC) 07, Quincy POC01, and Truckee POC01) showed elevated PM_{2.5} concentrations. The remaining monitors showed slightly increased concentrations on July 5 - the day the fire started, and July 11 - the day the fire was contained.

Figure 2: PM_{2.5} Federal Reference Method monitors in and around Plumas County, CA: June – August, 2007.



Wildfire smoke is a mixture of gas and particulate matter and can adversely affect air quality. Satellite images, narrative, and new stories, were submitted as part of CARB’s June 2009 package.⁶

Given this evidence and the information presented in sections five and six below, we can reasonably conclude that the event in question had the potential to affect air quality.

4.2 Not Reasonably Controllable or Preventable

Pursuant to 40 CFR §50.14(c)(3), a state that is requesting exclusion of data affected by an exceptional event must submit a demonstration to EPA to justify the exclusion. One of the justification criteria is a showing that the event was “not reasonably controllable or preventable.” A determination of whether a particular event was reasonably controllable or preventable depends on the specific facts and

⁶June NED, Attachment 4 and Attachment 5.

circumstances surrounding the event. Therefore, EPA addresses this and other criteria of the exceptional events rule on a case by case basis.⁷

The Exceptional Events Rule defines a wildfire as an unplanned, unwanted wildland fire “such as a fire caused by lightning...”⁸ The Antelope Complex Fire was caused by lightning and therefore qualifies as a wildfire. CARB’s submittal notes that there was no prescribed burning in the area and that July 8 was declared a “no-burn” day by the California Department of Forestry and Fire Protection.⁹

We conclude that CARB has demonstrated that the event in question was an unplanned wildfire ignited by an uncontrollable natural event, and was not reasonably controllable or preventable.

4.3 Natural Event

The Exceptional Events Rule states that “both wildfires and wildland fire use fires fall within the meaning of ‘natural events’ as that term is used in CAA § 319. Therefore, ambient particulate matter and ozone concentrations due to smoke from a wildland fire will be considered for treatment as an exceptional event if the fire is determined to be either a wildfire or wildland fire use fire.”¹⁰

CARB asserts that the July 8, 2007 exceedance is a direct result of the lightning-ignited Antelope Complex Fire. A U.S. Department of Agriculture – Forest Service news release and other news reports submitted as part of CARB’s package confirm that the Antelope Complex Fire was a result of lightning strikes.¹¹ The event therefore qualifies as a natural event.

5.0 Clear Causal Relationship

Section 319 of the CAA and 40 CFR §50.14(c)(3)(iii) require the State to demonstrate that there is a clear causal relationship between the measurement under consideration and the event that is claimed to have affected air quality in the area.

As shown in Figure 1, CARB and the Northern Sierra Air Quality District run a number of PM_{2.5} FRM monitors in counties surrounding the Antelope Complex Fire. The two closest to the fire are the Portola monitor and the Quincy monitor. According to CARB’s submittal, the Portola monitor is in a valley about 23 miles southeast from the center of the fire, sited at an elevation of about 4,895 feet. The Quincy monitor is approximately 24 miles southwest of the center of the fire, at an elevation of about 3,422 feet, and is located in a separate valley. The fire was located at an elevation of about 5,000 feet.¹² Due to the area’s hill and valley terrain, air masses impacting one valley may not impact another neighboring valley.

The various monitors sample at different frequencies. The Quincy POC01 and Truckee POC01 FRM monitors sample once every three days, and collected data on July 8, 2007 while the fire burned. In Portola, there were two monitors running in July 2007. Each sampled every 6th day, but on a staggered

⁷ 72 FR 13560, 13564

⁸ 72 FR 13560, 13566

⁹ June NED, p. 10.

¹⁰ 72 FR 135660, 13566

¹¹ June NED, Attachment 3.

¹² December Natural Events Documentation (NED), p. 1.

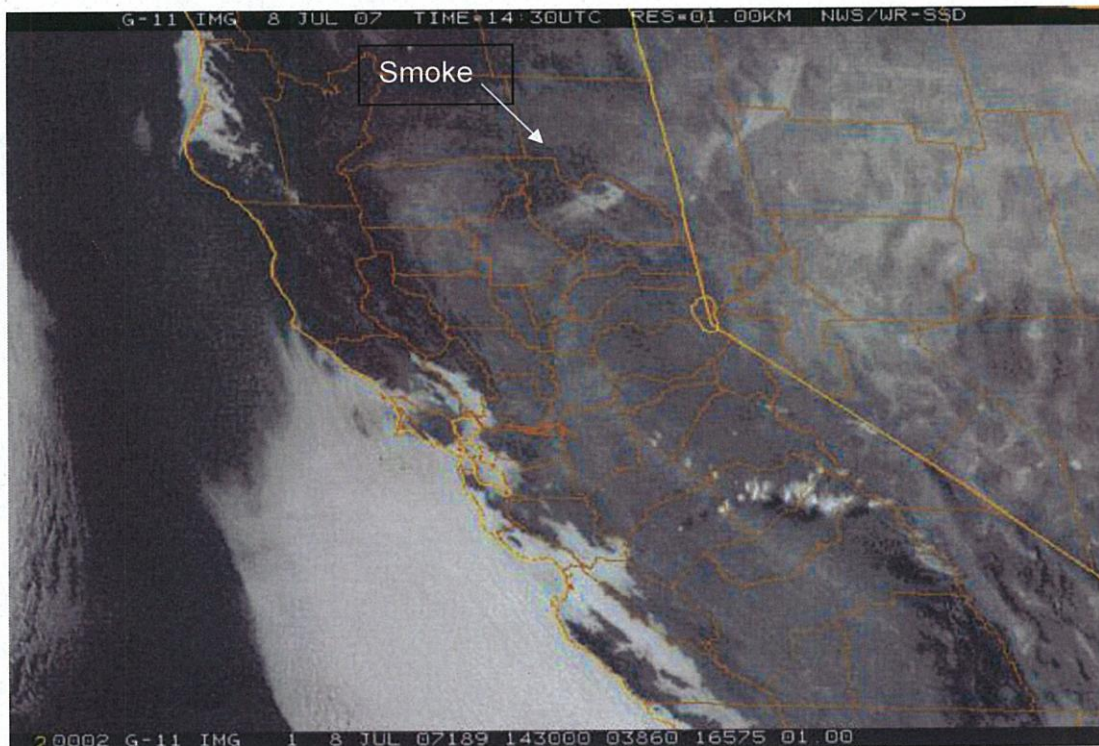
schedule. While the POC01 Portola monitor measured on July 5, 11, and 17, the POC07 Portola monitor measured on July 2, 8, and 14. Portola therefore also had a monitor that sampled on July 8. As shown in Table 2, both Portola POC07 and Quincy POC01 monitored elevated concentrations on July 8, 2007, and significantly lower values on July 5 and July 11. Other monitors located further away from the fire showed slightly elevated concentrations at the time of the fire.

Table 2. PM_{2.5} FRM Monitored Values: July 5-11, 2007. (µg/ m³)

	Portola (AQS: 06-063- 1009-07)	Portola (AQS: 06-063- 1009-01)	Quincy (AQS: 06-063-1006- 01)	Truckee (AQS: 06-057- 1001-01)	Grass Valley (AQS: 06-057- 0005-01)	Chico (AQS: 06-007-0002- 01)	Redding (AQS: 06-089- 0004-01)
7/2/2007	3	-	4	3	-	-	-
7/5/2007	-	6	8	6	8	12	7
7/8/2007	41	-	25	15	-	-	-
7/11/2007	-	11	12	13	6	6	6
7/14/2007	4	-	5	7	-	-	-

Wildfire smoke is a mixture of gas and particulate matter and can adversely affect air quality. A huge plume of smoke was reported both in local news stories and in the National Oceanic and Atmospheric Administration’s (NOAA) descriptive text narrative for smoke/dust observed in satellite imagery. Satellite images taken by NOAA’s Geostationary Operational Environmental Satellite (GOES) server also show what appear to be smoke plumes originating at the first and disseminating over surrounding areas. Figure 3 shows a satellite image for 7:30am on July 8, 2007. This image, as well as additional satellite images, narrative, and news stories, were submitted as part of CARB’s June 2009 package.¹³

Figure 3. NOAA GOES Satellite Image – July 8, 2007 (7:30am PDT)



¹³June NED, Attachment 4 and Attachment 5.

CARB also conducted modeling to demonstrate whether smoke from the Antelope Complex Fire may have affected the Portola monitor on July 8, 2007. On December 22, 2009, CARB supplied revised forward trajectories that modeled the movement of air parcels from the estimated location of the Antelope Complex Fire using the NOAA Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) model. CARB used United States Forestry Service coordinates to orient the fire in the model.

Figure 4 is a forward trajectory from the Antelope Complex Fire's modeled location, representing July 8, 2007 from the hours of midnight to midnight. According to the HYSPLIT trajectory, the Portola site was directly affected by the fire on July 8, 2007. The trajectory also indicates that Quincy may have experienced some smoke affects, and Grass Valley appears to have been minimally affected. This modeling result compares well against actual monitored concentrations. Of the monitors in the area, Portola recorded the highest concentration on July 8, with Quincy recording roughly half the Portola value (Table 2). Grass Valley did not monitor on July 8, but shows lower concentrations on July 11 than Portola and Quincy. Additional trajectories are included in CARB's December 22, 2009 supplemental information.¹⁴

Figure 4. Forward HYSPLIT Trajectory - July 8, 2007 (every hour)

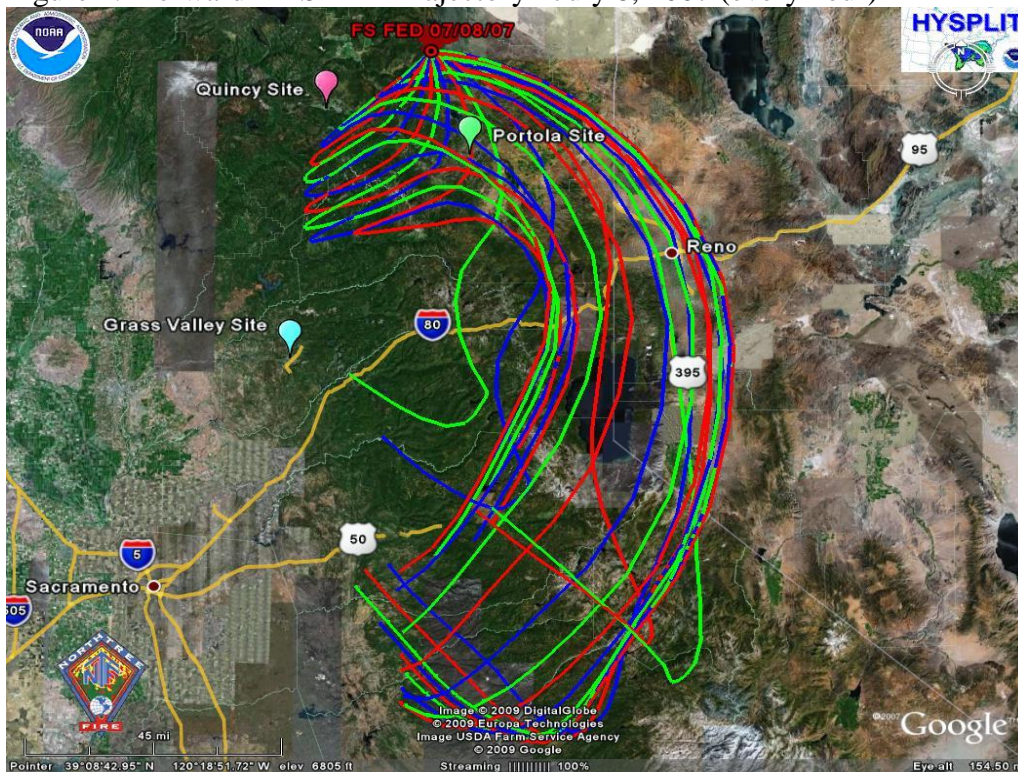


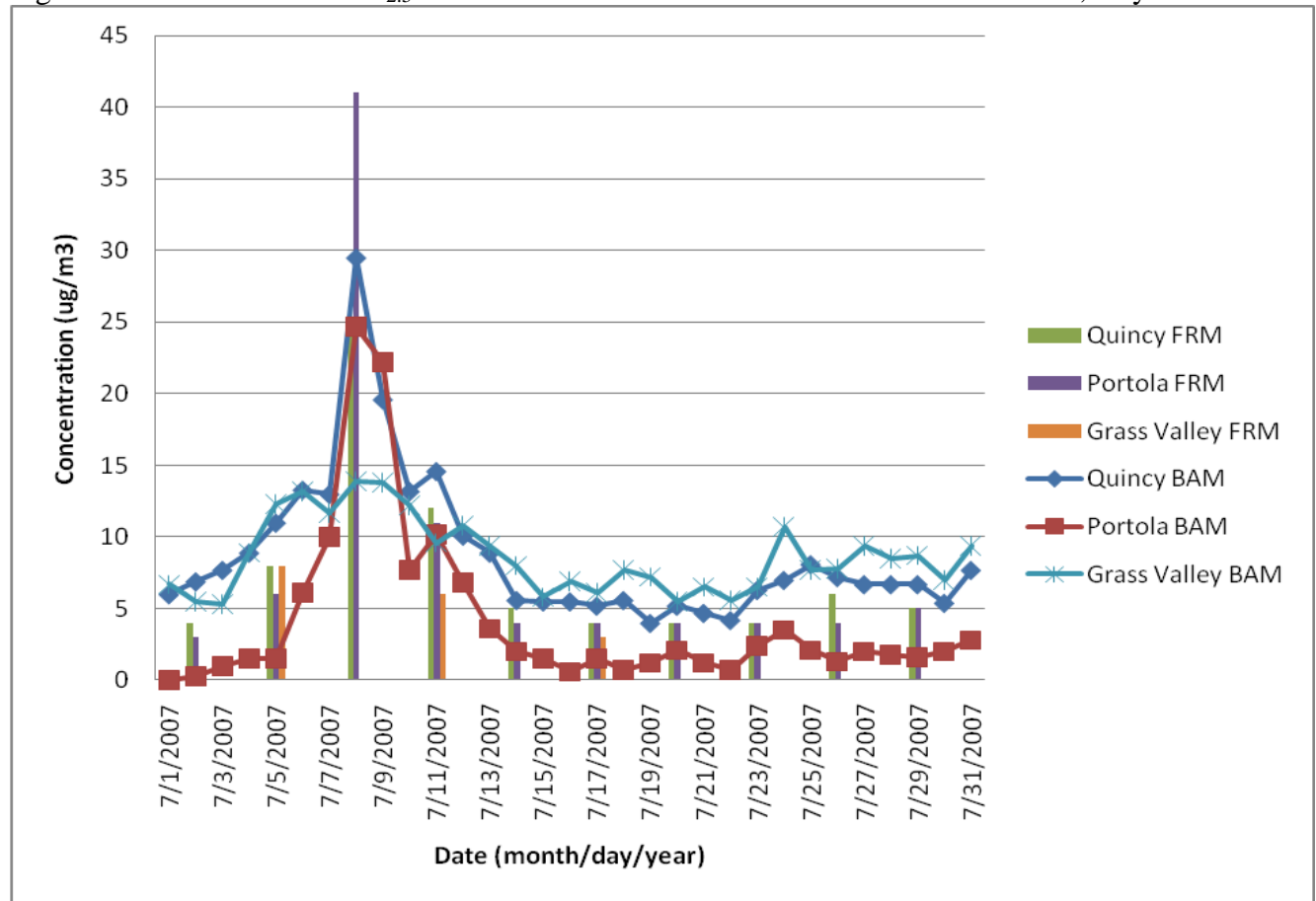
Figure 5 shows PM_{2.5} concentrations collected at Portola, Quincy, and Grass Valley monitoring stations in July 2007. In addition to PM_{2.5} FRM filter-based monitors it shows 24-hour averages from the PM_{2.5} Beta Attenuation Method (BAM) continuous analyzers. This type of analyzer was not approved for FEM status until 2008¹⁵ and therefore does not meet 40 CFR §58 requirements for

¹⁴ December NED, p. 2-7.

¹⁵ 73 FR 13224

NAAQS comparison in this instance. The BAMs therefore provide additional information on the days the FRMs did not monitor, but are not directly compared against the NAAQS. All FRM and BAM monitors show increased concentrations between July 5 and July 11, with July 8 showing the highest concentrations. On July 8, the Portola BAM is lower than the Quincy BAM. This is likely due to a malfunction of the Portola BAM which caused it to lose several hours of data.¹⁶

Figure 5: FRM and BAM PM_{2.5} concentrations recorded at Northern Sierra monitors, July 2007.



The Portola site did not collect carbon speciation data during this time period. Levoglucosan speciation data, used to indicate wood smoke, was collected at Portola on a once-every-six-days schedule. Data from July 5 and July 11, 2007 show negligible levoglucosan levels ($0.01 \mu\text{g}/\text{m}^3$ for both days), indicating little or no impact from wood smoke on those two days at Portola. As levoglucosan was not sampled on July 7, no conclusion is possible for the event day in question based on levoglucosan data.

While the speciation data are inconclusive, the trajectory modeling and satellite images indicate that the Portola monitor was affected by smoke from the Antelope Complex Fire on July 8, 2007, and monitored values also increase following the July 5, 2007 lightning strikes. CARB's submission also includes local news articles that further document the wildfire and its impact on air quality.¹⁷ The evidence suggests a clear causal relationship between the July 8, 2007 exceedance and the Antelope Complex Fire.

¹⁶ December NED, p. 8.

¹⁷ June NED, Attachment 4 and Attachment 5.

6.0 Concentrations in Excess of Normal Historical Fluctuations

Pursuant to 40 CFR §50.14(c)(3)(iii)(C), the demonstration must show that “the event is associated with a measured concentration in excess of normal historical fluctuations.” There is no “bright line” or specific threshold test for this requirement, but concentrations in the high percentiles can provide supporting evidence.¹⁸

PM_{2.5} levels in Plumas County vary by season. Use of woodburning stoves results in higher wintertime concentrations, while summertime PM_{2.5} levels in Plumas County typically fall between 0-10 µg/m³ (see Figure 6).

For Portola, CARB has flagged a number of summer days in the AQS for exceptional events review. All flagged days are associated with summer fires. From 2000 to 2008, the highest, non-flagged summer value monitored at Portola was 17.0 µg/m³. July 8, 2007’s value of 41.0 µg/m³ is more than double this maximum concentration. If one considers both flagged and non-flagged data, the July 8, 2007 value of 41.0 µg/m³ falls within the 98th percentile (see Table 3). As shown in Table 3 and Figure 6, the July 8, 2007 value far exceeds the normal range of values observed during the summer months in Portola.

Table 3. Portola Monitor: Highest PM_{2.5} concentrations, Summers (Jun - Aug) 2000-2008.

Date	PM _{2.5} concentration (µg/ m ³)	Data Percentile	AQS flag
June 26, 2008	113.5	100%	rt
July 23, 2008	68.6	100%	rt
July 11, 2008	56.0	99%	rt
Aug 22, 2000	43.0	99%	e
June 23, 2008	41.2	98%	rt
July 8, 2007	41.0	98%	e
June 29, 2008	31.5	97%	rt
June 17, 2000	17.0	97%	none

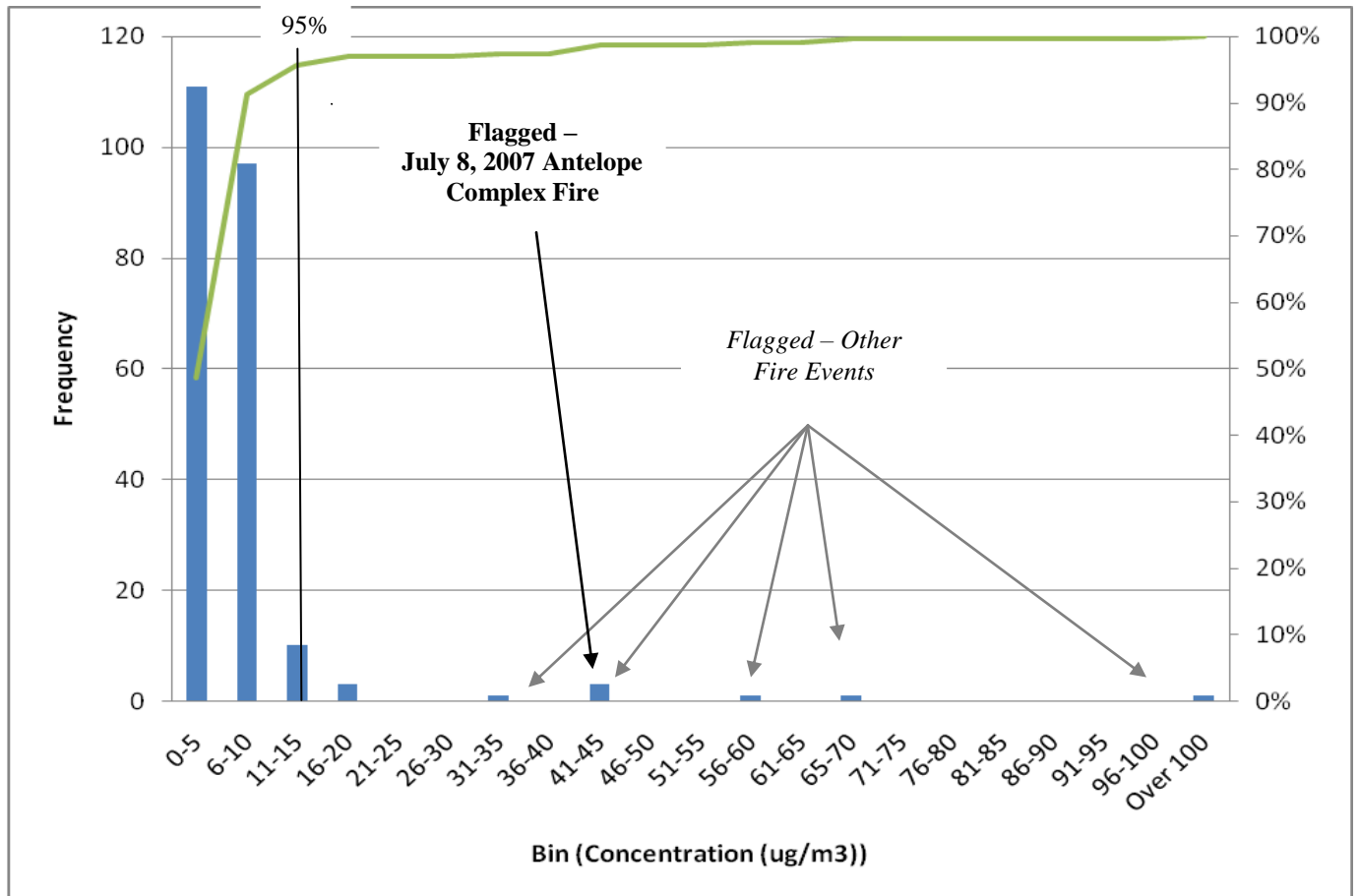
rt = Wildfire-U.S.

e = Forest Fire

*Uses POC7 data for Jun-Aug 2007; uses POC1 data for all other years. No 2002 data available for Portola.

¹⁸ Exceptional Events Rulemaking (EER) Preamble, 72 FR 13569

Figure 6. Distribution of Summer (Jun - Aug) PM_{2.5} FRM Concentrations at Portola, 2000-2008.



*Uses POC07 data for Jun-Aug 2007; uses POC01 data for all other years. No 2002 data available.

These values are evidence that the concentration measured on July 8, 2007 is in excess of normal historical fluctuations and is a clear outlier value at the Portola monitor.

7.0 No Exceedance But For the Event

Pursuant to 40 CFR §50.14(c)(3)(iii)(D), the demonstration must show that “there would have been no exceedance or violation but for the event.” The weight of evidence in a demonstration does not require a precise estimate of the estimated air quality impact from the event,¹⁹ though that could be useful. Concentrations on days with similar emissions but without the influence of the event are rough evidence of what the concentration on the event day would have been but for the event. Comparison to otherwise similar days may provide one kind of evidence in the demonstration that the exceedance would not have occurred but for the event.

Table 4 shows concentrations just before and after the claimed exceptional event day. The FRM monitor collects a sample once every three days and is relevant for comparison against the NAAQS. Although the continuous BAM monitor was not an approved FEM at the time of monitoring and is

¹⁹ EER Preamble 72 FR 23570

therefore not relevant for comparison against the NAAQS in this instance, the Portola BAM data are provided for informational purposes. Three days before the event, the FRM monitor measured 6.0 $\mu\text{g}/\text{m}^3$, then rose to 41.0 $\mu\text{g}/\text{m}^3$ on July 8, and three days later decreased to 11.0 $\mu\text{g}/\text{m}^3$. The continuous Portola BAM monitor measured 10.0 $\mu\text{g}/\text{m}^3$ the day before the flagged event, increased to 24.7 $\mu\text{g}/\text{m}^3$ on July 8, remained elevated on July 9, and decreased down to 7.7 $\mu\text{g}/\text{m}^3$ by July 10. The BAM data shows elevated concentrations from the day the fire started (July 5, 2007) until a few days after the fire was contained on July 11, 2007. Higher concentrations may be seen following containment due to lingering smoke in the atmosphere, smoke from embers, or smoke from contained but not fully extinguished portions of the fire.

Table 4. Portola BAM and FRM Concentrations, July 1 – July 15, 2007

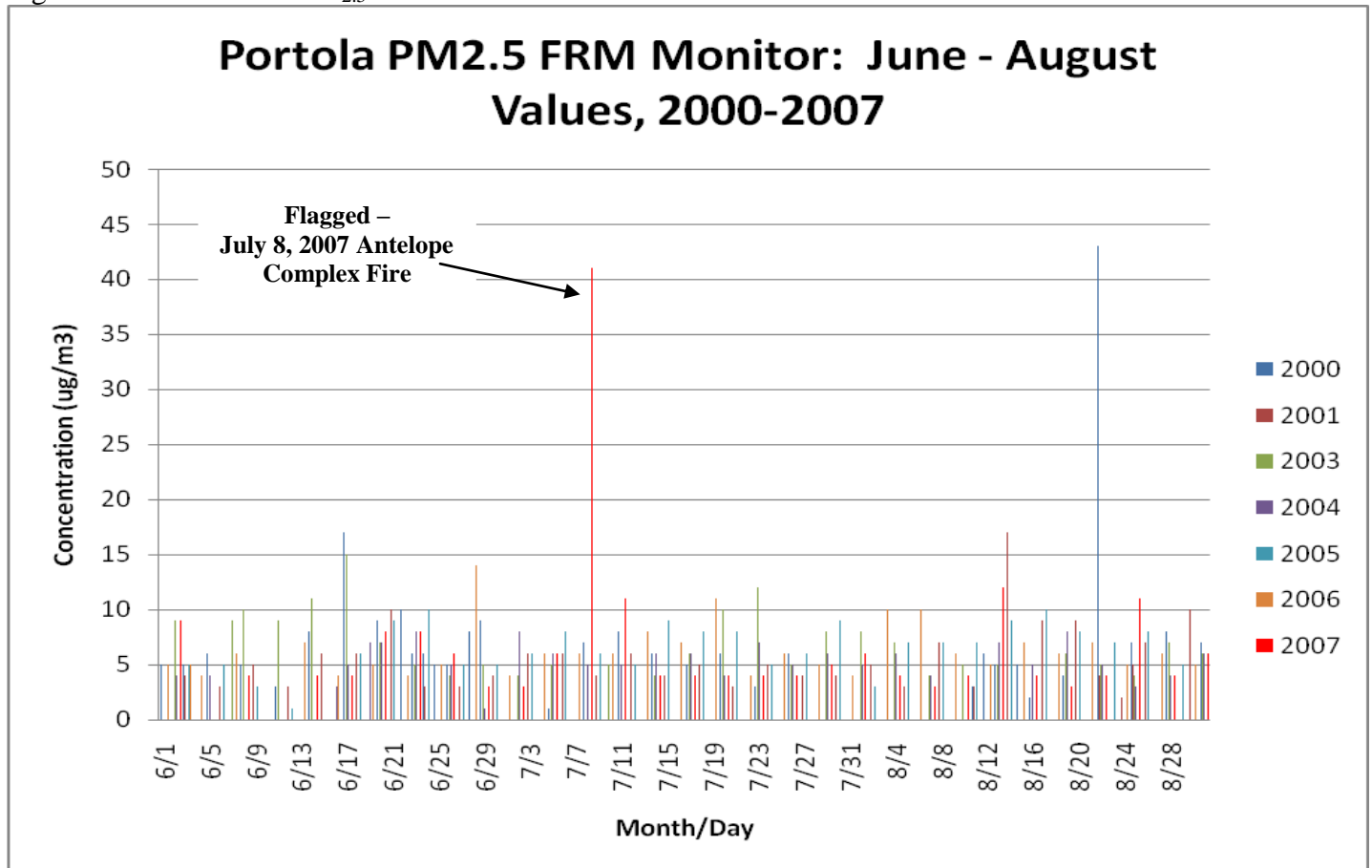
Date	Portola BAM Concentration ($\mu\text{g}/\text{m}^3$)	Portola FRM Concentration ($\mu\text{g}/\text{m}^3$)
7/1/2007	0	-
7/2/2007	0.3	3.0
7/3/2007	1	-
7/4/2007	1.5	-
7/5/2007	1.5	6.0
7/6/2007	6.1	-
7/7/2007	10	-
7/8/2007	24.7	41.0
7/9/2007	22.2	-
7/10/2007	7.7	-
7/11/2007	10.2	11.0
7/12/2007	6.8	-
7/13/2007	3.6	-
7/14/2007	2	4.0
7/15/2007	1.5	-

The FRM and BAM data show a clear spike in concentrations concurrent with the Antelope Complex Fire, indicating that but for the fires, the Portola FRM would not have exceeded the standard on July 8, 2007.

Data from 2000-2007 also indicate that but for the fires, $\text{PM}_{2.5}$ levels would not have reached 41.0 $\mu\text{g}/\text{m}^3$. Figure 7 shows summer concentrations for Portola, measured 2000-2001, and 2003-2007. Portola did not measure $\text{PM}_{2.5}$ during the summer of 2002. Data from the primary Portola monitor as well as a temporary Portola monitor that operated from 2007 through early 2008 is included for 2007.

Meteorological conditions during this seven year period would be expected to include multiple days with meteorology similar to that of July 8, 2007. Out of 213 monitored summer days, only one value matches July 8, 2007 in magnitude. This value, recorded in August 2000, is flagged in AQS as a forest fire event. Other than this single other value, the July 8, 2007 event at Portola is well above recorded concentrations for summers 2000-2007.

Figure 7. Summertime PM_{2.5} Values at Portola: 2000-2007.



Since no PM_{2.5} speciation data was collected in the Portola area on the day in question, an organic mass apportionment was not possible. The magnitude of the observed concentration compared to days just before and just after, the value's uniqueness over seven years of data, together with wind trajectories that strongly support the transport of smoke into the Portola area, present sufficient evidence to conclude that there would have been no exceedance of the 24-hour standard but for the event.

8.0 Procedural Requirements

The EER at 40 CFR §50.14(c) requires that data claimed to be due to an exceptional event must be flagged in the AQS database, that an initial description of the event be provided to EPA by July 1 of the year following the event, and that the State must submit a demonstration to EPA within three years of the event.

The event was flagged in AQS as required by 40 CFR §50.14. On June 17, 2009, CARB submitted their demonstration to EPA for the July 8, 2007 event. CARB sent additional clarification on December 22, 2009.

40 CFR §50.14(c)(3)(i) also requires notice and opportunity for public comment. 40 CFR §50.14(c)(3)(i) requires that any public comments be submitted along with the demonstrations. The Northern Sierra Air Quality Management District (NSAQMD) public noticed the July 8, 2007 package from May 5, 2009 through June 5, 2009 on the NSAQMD website. No public comments were received.²⁰

Smoke and Health Information issued by the Plumas National Forest in response to the July 8, 2007 fires was included in the July 8, 2007 package.²¹

9.0 Conclusion

Documentation submitted by CARB claims that smoke from the Antelope Complex Fire caused an exceedance of the 24-hour PM_{2.5} NAAQS at the Portola site on July 8, 2007. Forward HYSPLIT trajectories as well as satellite photographs strongly support the possibility of smoke impacts in the Portola area on July 8, 2007. The value measured on July 8, 2007 is above the site's 95th percentile observed during summer months (June – August), 2000-2008. The value far exceeds the expected range of concentrations for unflagged days and falls into the 98th percentile when considering all data (flagged and unflagged). Since no PM_{2.5} speciation data was collected in the Portola area on the day in question, an organic mass apportionment was not possible. The information and analyses presented in this package and in CARB's submittal documents do not represent the entire suite of possible evidence for exceptional event packages. For other types of events and other pollutants, additional or alternate evidence may be necessary to make an exceptional event determination. In this particular instance, however, given that the event is a wildfire affecting a 24-hour PM_{2.5} concentration, the cause of the event (lightning), the magnitude of the observed concentration compared to days just before and after, historical levels at the site, wind trajectories that support the transport of smoke into the Portola area, and satellite images and news articles combine to provide sufficient evidence to satisfy the EER criteria. Provided this weight of evidence, EPA concurrence is given to the exceptional event flag on the Portola monitor's July 8, 2007 PM_{2.5} concentration.

10.0 Citation of Exceptional Event Request Documentation

June NED June 17, 2009 Natural Event Documentation

"Natural Event Document: Antelope Fire, July 2007," California Air Resources Board, August 28, 2009, with attachments.

Letter from Karen Magliano, Air Resources Board, to Matthew Lakin, U.S. Environmental Protection Agency Region 9, June 17, 2009 requesting exclusion of July 8, 2007 exceedance, with enclosures: June NED; Letter from Gretchen Bennett, Northern Sierra Air Quality Management District, to Karen Magliano, California Air Resources Board, June 9, 2009, requesting exclusion of the July 8, 2007 exceedance; photocopy of public notice, "Natural Event Document for July 8, 2007 Portola Smoke Incursion from Antelope/Wheeler Complex Fire, Plumas County."

December NED December 22, 2009 Natural Event Documentation

"July 8, 2007 Portola Exceptional Event," California Air Resources Board, December 22, 2009.

²⁰ Letter from Karen Magliano, attachment.

²¹ June NED, Attachment 1.