UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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SEP 1 9 2017

Christine Kirby, Assistant Commissioner
Bureau of Air & Waste
Department of Environmental Protection
One Winter Street, 7th floor
Boston, MA 02108

RE: Exceptional Events Demonstration

Dear Assistant Commissioner Kirby:

On May 25, 2017, the Massachusetts Department of Environmental Protection (MassDEP) submitted an exceptional event demonstration claiming that emissions from the 2016 Fort McMurray wildfire caused elevated ozone levels in Massachusetts which exceeded the 8-hour Ozone National Ambient Air Quality Standards (NAAQS) at the Chicopee and Ware air monitoring stations on May 25 and 26, 2016. The ozone concentrations exceeded the 2015 Ozone NAAQS at both monitoring locations, and in some cases exceeded the 1997 and 2008 Ozone NAAQS.

MassDEP's exceptional event demonstration was submitted in accordance with the revised Exceptional Events Rule found in sections 50.14 and 51.930 of 40 CFR parts 50 and 51.[1] After careful consideration of the information provided, the EPA concurs, based on the weight of the evidence, that MassDEP has made the demonstrations referred to in 40 CFR 50.14(a)(2), (b)(1) and (b)(4). In addition, MassDEP has met the schedule and procedural requirements in section 50.14(c) with respect to the same information. The EPA has reviewed the documentation provided by MassDEP to demonstrate that the exceedances identified in the submitted demonstration for the dates of May 25 and 26, 2016, at the Chicopee and Ware monitoring stations meet the criteria for an exceptional event in the rule. The basis for our concurrence is set forth in the enclosed technical support document. The EPA will enter "concurrence flags" for these data into the EPA's Air Quality System (AQS) data repository.

The EPA's concurrence is a preliminary step in the regulatory process for actions that may rely on the dataset containing the event-influenced data and does not constitute final Agency action. If the EPA takes a regulatory action that is affected by exclusion of the ozone data for May 25 and 26, 2016 at the Chicopee and Ware monitoring stations, the EPA will publish notice of its proposed action in the Federal Register. The EPA's concurrence and accompanying technical support document will be included in the record as part of the technical basis for that proposal. When the EPA issues that regulatory action, it will be a final Agency action subject to judicial review.

[1] *See* "Treatment of Data Influenced by Exceptional Events," 81 FR 68216 (October 3, 2016).

If you have any questions regarding this matter, please don't hesitate to contact David Conroy at (617) 918-1661.

Sincerely,

Deborah A. Szaro

Deborah A. Szaro
Acting Regional Administrator

cc: Mark Wert, MassDEP

ENCLOSURE: TECHNICAL SUPPORT DOCUMENT FOR EPA CONCURRENCE ON OZONE EXCEEDANCES MEASURED IN MASSACHUSETTS ON MAY 25 AND 26, 2016 AS EXCEPTIONAL 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, EPA finalized revisions to the Exceptional Events Rule. The 2007 Exceptional Events Rule and 2016 Exceptional Events Rule revisions added sections 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. EPA reviews the information and analyses in the air agency's demonstration package using a weight of evidence approach and decides to concur or not concur. The demonstration must satisfy all of the Exceptional Events Rule criteria for the EPA to concur with excluding the air quality data from regulatory decisions.

Under 40 CFR §50.14(c)(3)(iv), the air agency demonstration to justify data exclusion 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."[1]

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),

[1] 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."

2. completion and documentation of the public comment process described in 40 CFR §50.14(c)(3)(v), and

3. implementation of any applicable mitigation requirements as described in 40 CFR §51.930.

For data influenced by exceptional events to be used in initial area designations, air agencies must also meet the initial notification and demonstration submission deadlines specified in Table 2 to 40 CFR §50.14.

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 ozone (O_3) events, the narrative conceptual model should 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 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.[2] 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.

[2] Guidance on the Preparation of Exceptional Events Demonstrations for Wildfire Events that May Influence Ozone Concentrations, September 16, 2016. Available at https://www.epa.gov/air-quality-analysis/exceptional-events-rule-and-guidance.

- 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 ppb higher) from non-event exceedances.

    - 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.

    - *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 5-year distribution of O_3 monitoring data, OR
        - is one of the four highest O_3 concentrations within 1 year (among those concentrations that have not already been excluded under the Exceptional Events Rule, if any).

    - In addition to the analysis required for Tier 1, the air agency should supply additional information 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

EPA 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.[3]

Natural Event or Event Caused by Human Activity That is Unlikely to Recur

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.

OVERVIEW OF EVENT

On November 9, 2016, the Massachusetts Department of Environmental Protection (MassDEP) submitted an Initial Notification of Potential Exceptional Event for elevated O_3 concentrations at multiple monitoring stations in Massachusetts on May 25 through 28, 2016. The EPA determined at the time that data exclusion of some of the exceedances of the O_3 National Ambient Air Quality Standard (NAAQS) may have a regulatory significance for future year design values, and worked with MassDEP to identify the relevant exceedances and monitoring sites affected.

On May 25, 2017, MassDEP submitted an exceptional event demonstration for four exceedances of the 8-hour O_3 NAAQS, that occurred at the Chicopee and Ware monitoring locations in western Massachusetts on May 25 and 26, 2016. The O_3 concentrations exceeded the 2008 and 2015 O_3 NAAQS at both of the monitoring locations, and in some cases exceeded the 1997 O_3 NAAQS.[4] Table 1 summarizes these exceedances.

In their demonstration, MassDEP indicated that the elevated O_3 measured on May 25 and 26, 2016 was the result of high levels of O_3 and O_3 precursors that were transported within the smoke plume from a wildfire in the Ft. McMurray area of Alberta, Canada into Massachusetts. On May 1, 2016, a wildfire of unknown origin began southwest of Ft. McMurray and continued to grow in size spreading across Alberta and into Saskatchewan. The rapid growth and duration

[3] 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."

[4] The Clean Air Act requires the EPA Administrator to set primary air quality standards to protect public health with an "adequate margin of safety," including the health of at-risk groups. The law also requires the EPA to review the standards -- and the science behind them -- every five years to determine whether changes are warranted. In 1997, the EPA established the first 8-hour O_3 NAAQS at 84 parts per billion (ppb). The 8-hour O_3 NAAQS was updated during subsequent reviews in 2008 (75 ppb) and 2015 (70 ppb).

of the fire was aided by unusually hot and dry weather conditions over northern areas of Alberta. The situation worsened during the first weeks as winds began gusting at speeds exceeding 40 miles per hour. The fire was not officially declared under control until more than two months later on July 5 after spreading across nearly 1.5 million acres and destroying 2,400 homes. It is the costliest disaster in Canadian history. The smoke plumes from the wildfire spread across Alberta, Saskatchewan, and the north central portion of the U.S. before eventually moving into the northeast U.S.

Table 1: 8-hour O_3 Exceedance Summary

Exceedance Date	Monitor/Site Name	AQS ID	8-hour Avg. (ppm)
May 25, 2016	Chicopee	25-013-0008	0.077
May 25, 2016	Ware	25-015-4002	0.076
May 26, 2016	Chicopee	25-013-0008	0.090
May 26, 2016	Ware	25-015-4002	0.089

Narrative Conceptual Model

MassDEP's demonstration provided a narrative conceptual model to describe how emissions from the Ft. McMurray fire in Alberta, Canada influenced O_3 exceedances at the Chicopee and Ware monitoring locations and included additional information to support their claim.

In their discussion, MassDEP included information for non-event characteristics in Massachusetts, including a description of the two primary scenarios of O_3 exceedances based on synoptic meteorological patterns. Specific to the observed event, MassDEP described the scenario in which exceedances are typically observed in the western part of the State as a result of south-southwesterly wind flow across Massachusetts carrying pollutants from the northeast urban corridor. This flow keeps the main pollutant plume off Cape Cod and south coast as the southerly breezes there draw in cleaner maritime air. However, winds during the event originated from the normally clean air area to the northwest that typically results in low O_3 levels in Massachusetts. To support this claim, MassDEP provided annual O_3 wind roses for 2011-2016 showing elevated O_3 levels are generally associated with southerly component winds. Therefore, the typically necessary meteorological conditions were not present to cause the exceedances that were observed on May 25 and 26, 2016.

MassDEP provided information on the vast size of the Ft. McMurray fire from media reports and described how wildfire smoke plumes enhance nearby O_3 levels, as well as augment O_3 levels far from the fire due to the buildup and long-range transport of O_3 precursors within the plume. Photochemical modeling results simulating wildfire smoke effects on O_3 also provide evidence of enhancement. MassDEP explained that smoke from biomass burning contains O_3 precursors such as nitrogen oxides (NO_X) and volatile organic compounds (VOCs) and that long-range transport of smoke can significantly enhance O_3 concentrations by as much as 25-100 ppb. MassDEP contends that based on the considerable size of the Ft. McMurray fire, significant amounts of NO_X and VOCs were emitted from the fire and became trapped in a large area of high pressure as the plume moved eastward across the upper Midwest and Great Lakes region into Massachusetts.

Because O_3 exceedance days in Massachusetts are largely due to the transport of O_3 and O_3 precursors from upwind states, MassDEP provided an analysis of NO_X emissions from upwind electric generating units (EGUs) in New York to demonstrate that the exceedances on May 25 and 26 cannot be attributed, at least in part, to upwind EGUs operating on high electric demand days as is more typically the case later in the O_3 season.

MassDEP's demonstration indicated that the proposed data exclusion may have regulatory significance for future year design values because the current design value is at the 2015 O_3 NAAQS. Based on preliminary data for the 2017 O_3 season, the proposed data exclusion could impact future attainment of the 2015 O_3 NAAQS at the Chicopee monitor. MassDEP summarized the event and included several data analyses to show evidence that smoke was transported from the Ft. McMurray fire into western Massachusetts and impacted the ground-level monitors at Chicopee and Ware.

Based on the information described above, MassDEP's demonstration meets the narrative conceptual model criterion of the Exceptional Events Rule.

Table 2: Documentation of Narrative Conceptual Model

Exceedance Date	**Demonstration Citation**	**Quality of Evidence**	**Criterion Met?**
May 25, 2016	Section 2 - 7 (pages 5 – 14)	Sufficient	Yes
May 26, 2016	Section 2 - 7 (pages 5 – 14)	Sufficient	Yes

Clear Causal Relationship and Supporting Analyses

MassDEP's demonstration contained multiple analyses to demonstrate a clear causal relationship between the Ft. McMurray fire and the monitored exceedances consistent with the EPA's wildfire O_3 guidance. These analyses are presented throughout the demonstration.

Comparison with historical concentrations

MassDEP included a comparison of historical concentrations, as required by 40 CFR §50.14(c)(3)(iv)(C). MassDEP compared the event-related O_3 concentrations with historical data and determined the maximum daily 8-hour O_3 concentration met or exceeded the 99th percentile for observed data over the last six years for the Chicopee and Ware monitoring locations on May 25 and May 26. In addition, MassDEP showed that the daily 8-hour maximum O_3 concentrations observed at each monitor on May 25 and May 26 were two of the four highest recorded during the most recent six-year early O_3 season history (May 1 – June 30). The demonstration also noted that the O_3 concentrations observed at Chicopee and Ware on May 26 were the highest recorded value of a six-year period by a margin of 6 ppb and 5 ppb, respectively. This demonstrates the exceptionality of the observed O_3 concentrations during the event.

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. Although the bulk of O_3 exceedance days at Chicopee and Ware usually occur during the June-August timeframe, exceedances do occur in May and September. The event-related exceedances identified in this demonstration occurred during the regular O_3 season,

during times when other exceedances have been historically measured. Therefore, the event exceedances do not meet the Tier 1 Key Factor, and additional evidence beyond a Tier 1 analysis is needed to support the clear causal relationship.

Tier 2: Key Factors

Because the influence of the Ft. McMurray fire was not clearly higher than non-event related concentrations or outside of the normal O_3 season for the data requested for exclusion, MassDEP evaluated the Tier 2 Key Factors in Attachment 1 and Section 8 of the demonstration. For Tier 2 Key Factor 1, MassDEP relied upon an analysis performed by the Connecticut Department of Energy and Environmental Protection (CT DEEP) in their exceptional events demonstration for the same event and days. Included in the demonstration as Attachment 1, CT DEEP provided an analysis of fire emissions (Q) and distance (D) of the wildfire to the affected monitoring station locations. CT DEEP determined that due to the vast size of the fire and weather patterns that it was appropriate to calculate a multiday Q/D using area estimates of the fire from the week preceding the event. CT DEEP used AP-42 emission factors for North Central U.S. conifer forest as a conservative estimate of emissions. Due to the great distance of over 3,000 km between Ft. McMurray and Connecticut, the calculated value for Q/D was well below the EPA's recommended level of 100 tons per day per kilometer (tpd/km) to indicate clear causality. This analysis is applicable to the Chicopee and Ware monitoring locations because the distances are similar to those for the CT DEEP monitoring locations. Therefore, the event exceedances do not meet Tier 2 Key Factor 1.

For Tier 2, Key Factor 2, MassDEP compared the event-related O_3 concentrations with historical data for the April – September O_3 season over the past six years. As previously discussed, MassDEP's analysis determined the maximum daily 8-hour O_3 concentration exceeded the 99^{th} percentile for observed data at both of the monitoring locations on May 25 and May 26. In addition, all of the observed concentrations were among the four highest values measured in 2016. Therefore, both of the monitors meet the criteria for Tier 2 Key Factor 2.

Based on the analysis of the Key Factors for Tier 2, EPA's wildfire O_3 guidance document indicates that a Tier 3 analysis is appropriate for this event. As described below, MassDEP's demonstration included the required elements for a Tier 3 clear causal relationship analysis, based on EPA's wildfire O_3 guidance document. This includes evidence to support that wildfire emissions were transported from the wildfire to the monitors, wildfire emissions affected the monitors, and wildfire emissions contributed to the O_3 exceedances.

Evidence of transport of wildfire emissions from the wildfire to the monitors

MassDEP provided trajectory analysis using the Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) model. The analysis included a combination of backward- and forward-trajectories that show the movement of smoke from the Ft. McMurray fire to the upper Midwest and Great Lakes region, which was then transported across Michigan and upstate New York before eventually moving into Massachusetts.

MassDEP included a 120-hour forward-trajectory starting on May 18 at 1,000 meter (m), 1,500 m, and 3,000 m above ground level to show that parcels of the smoke plume would likely have been transported from the wildfire to the Great Lakes, arriving on or about May 21. MassDEP

noted that with surface high pressure over the Great Lakes region, particles within these parcels would have become trapped due to the light winds and limited mixing conditions associate with the high pressure system. This trajectory is consistent with visible smoke in the satellite imagery in the demonstration from NASA's Earth Observing System Data and Information System (EOSDIS).

The uncertainty of trajectory analysis increases with transport distance, frontal passages, and complex wind or terrain issues. Due to the large distance between the wildfire and Massachusetts, MassDEP continued their trajectory analysis by providing shorter, 36-hour back-trajectories for May 25 and 26 for the Chicopee and Ware monitoring locations. These back-trajectories showed air parcels were transported from the Great Lakes region across central and southern New York to the Chicopee and Ware monitors. In addition, the back-trajectories were overlaid on a map using satellite data from NOAA's Hazard Mapping System (HMS) illustrating the presence of the smoke plume within the air mass being transported to the monitors.

MassDEP also provided an analysis of organic carbon (OC) and potassium (K) species concentrations from upwind monitors in New York and Michigan. This analysis showed elevated OC and K levels associated with wildfire emissions corresponded with elevated O_3 levels observed at ground level as the smoke plume moved into the upper Great Lakes and eastward toward Massachusetts. Additionally, MassDEP provided HMS satellite imagery to show the progression of smoke plumes over North America from May 18 through May 26.

MassDEP provided surface weather maps from May 18 through 24 that were consistent with the formation of an area of high pressure over the Upper Great Lakes and the transport of emissions to New England. Additional surface weather maps were also provided to show winds at the time were generally from the west and west-northwest, and were light on May 26 due to the position of a cold front over central and western Massachusetts. The analysis indicated that meteorological conditions in the northeast on May 25 and May 26 were not favorable for the production of elevated O_3 at the levels observed during the event.

EPA's wildfire O_3 guidance document suggests that to show transport, satellite imagery should be accompanied by evidence of the plume reaching the ground. MassDEP provided data of elevated hourly O_3, Black Carbon (BC), carbon monoxide (CO), and fine particle $PM_{2.5}$ measurements at ground-level monitors, which are all associated with wildfire emissions. Webcam images of haze moving into the vicinity of the monitors during the event was also included in the demonstration.

Generally, the trajectory analysis, satellite imagery, and evidence of smoke reaching the ground show that emissions from the Ft. McMurray fire in Alberta, Canada were transported to the Chicopee and Ware monitors on both exceedance days.

<u>Evidence that the wildfire emissions affected the monitors and caused O_3 exceedances</u>
MassDEP's demonstration contained multiple analyses to support the weight of evidence that emissions from the wildfire affected the monitored O_3 concentrations. The demonstration included hourly $PM_{2.5}$, BC, and CO monitoring data from ground-level monitors indicating elevated levels during the event, likely due to the influence of smoke in the area. When data was

not available for one of the requested monitors, data from the nearest monitor with this information was provided. Ground-level monitors also showed spikes in the daily average concentrations of parameters indicative of smoke such as black carbon (BC) and DeltaC at other nearby monitoring locations with Aethalometers. DeltaC is the difference between 370 and 880 Aethalometer measurements (in $\mu g/m^3$), and has been found to be a strong indicator of wood smoke.[5] The data analysis shows upward spikes of BC at two nearby monitors and a large spike of DeltaC at one nearby monitor.

In the demonstration, MassDEP discussed how southwest wind flows are a more typical summertime airflow associated with elevated O_3 levels in western Massachusetts due to the transport of higher amounts of O_3 and O_3 precursor emissions from the northeast urban corridor. MassDEP illustrated this by providing back-trajectories for several other days with O_3 NAAQS exceedances at the Chicopee and Ware monitors. These back-trajectories support that elevated O_3 measurements at the monitors are consistent with air transport from the southwest. MassDEP also provided a matching-day analysis for several other days from the 2016 O_3 with similar 36-hour back-trajectories to those of May 25 and 26. On all of the similar days identified, O_3 levels remained relatively low despite mostly sunny skies and maximum temperatures ranging from 91 to 98 degrees F. (See Section 11 of MassDEP's Demonstration.) The analysis supports MassDEP's claim that O_3 concentrations are typically not elevated when associated with air trajectories from the west or west-northwest even with other favorable meteorology for O_3 formation.

MassDEP also provided a comparison of monitored concentrations to modeled predictions at the time of the event using the National Oceanic and Atmospheric Administration's Community Multiscale Air Quality (NOAA CMAQ) model. This model does not account for the influence of wildfire emissions. Although air quality models can both under- or over-predict concentration levels, it is unusual for a multi-day series of under- or over-predictions by a significant margin. Because the model for this time period in the eastern United States shows significant under- and over-predications as large at 10 ppb, the degree of negative bias in the model is likely evidence of the influence of the smoke plume on observed area O_3 concentrations.

MassDEP stated that the "comparisons and analyses presented in this section support MassDEP's conclusions that the wildfire event affected air quality in such a way that there exists a clear causal relationship between the Ft. McMurray wildfire and the monitored exceedances on May 25 and 26, 2016, and thus satisfies the clear causal relationship criterion in EPA's Exceptional Events rule."

The analyses in the demonstration, specifically, the comparison with historical O_3 8-hour maximum concentrations and percentile analysis, HYSPLIT analysis, satellite imagery, upwind OC and K data analysis, time series plots of hourly concentrations of O_3 and other ground-level pollutants associated with wildfire smoke, synoptic weather pattern analysis, comparison to non-event days with similar meteorology and matching day analysis, and the comparison of observed concentrations to predictions with NOAA CMAQ, sufficiently demonstrate a clear causal

[5] A Real-Time Wood Smoke Indicator Method – George Allen, NESCAUM 2006. (https://www3.epa.gov/ttnamti1/files/2006conference/allenrealtime.pdf)

relationship between the emissions generated by the Ft. McMurray wildfire and the exceedances measured at the Chicopee and Ware monitoring locations.

Table 3: Documentation of Clear Causal Relationship and the Supporting Analyses

Exceedance Date	Demonstration Citation	Quality of Evidence	Criterion Met?
May 25, 2016	Sections 6 – 11 (pages 10-70)	Sufficient	Yes
May 26, 2016	Sections 6 – 11 (pages 10-70)	Sufficient	Yes

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)]. MassDEP's demonstration provided evidence that the wildfire event meets the definition of a wildfire. Additionally, the EPA believes that it is not reasonable to expect a downwind air agency to have required or persuaded an upwind foreign country to have implemented controls on sources sufficient to limit event-related emissions in the downwind state. Therefore, the documentation provided sufficiently demonstrates that the event was not reasonably controllable and not reasonably preventable.

Table 4: Documentation of not Reasonably Controllable or Preventable

Exceedance Date	Demonstration Citation	Quality of Evidence	Criterion Met?
May 25, 2016	Section 13 (pages 72-73)	Sufficient	Yes
May 26, 2016	Section 13 (pages 72-73)	Sufficient	Yes

Natural Event or Event Caused by Human Activity That is Unlikely to Recur

Wildfires are defined at 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." MassDEP provided information which discusses the origin and evolution of the wildfire event. The Ft. McMurray fire qualifies as a natural event because non-prescribed human activity was suspected as the cause of the unplanned fire event which occurred on wildland. While the city of Ft. McMurray itself does not meet the definition of a wildland in the rule, O_3 exceedances occurred several weeks after the fire spread outside the town. Therefore, the wildfire emissions affecting O_3 concentrations at Chicopee and Ware were generated predominantly from sparsely populated forested areas that meet the definition of wildland. The EPA generally considers the emissions of O_3 precursors from wildfires on wildland to meet the regulatory definition of a natural event at 40 CFR 50.1(k). MassDEP has therefore shown that the event qualifies as a natural event.

Table 5: Documentation of Natural Event

Exceedance Date	Demonstration Citation	Quality of Evidence	Criterion Met?
May 25, 2016	Section 12 (pages 71-72)	Sufficient	Yes
May 26, 2016	Section 12 (pages 71-72)	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 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)	Section 15: page 74	Yes
Did the agency submit an Initial Notification of Potential Exceptional Event and flag the affected data in the EPA's Air Quality System (AQS)?	40 CFR §50.14 (c)(2)(i)	Provided to EPA on November 9, 2016	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 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)	May 23, 2017	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? • Did the agency submit to EPA any public comments received? • Did the state address comments disputing or contradicting factual evidence provided in the demonstration?	40 CFR §50.14 (c)(3)(v)	Attachment 2	Yes. MassDEP did not receive any public comments on the proposed demonstration.
Has the agency met requirements regarding submission of a mitigation plan, if applicable?	40 CFR §51.930(b)	Not Applicable	Not Applicable

Conclusion

EPA has reviewed the documentation provided by MassDEP to support claims that smoke from wildfires in Alberta, Canada contributed to exceedances of the 8-hour O_3 NAAQS at the Chicopee and Ware monitoring locations on May 25 and 26, 2016. The O_3 concentrations exceeded the 2015 O_3 NAAQS at both of the monitoring locations, and in some cases exceeded the 1997 and 2008 O_3 NAAQS. EPA has determined that the flagged exceedances at these monitoring sites on May 25 and 26 satisfy the exceptional event criteria: the event was a natural

event, which affected air quality in such a way that there exists a clear causal relationship between the event and the monitored exceedance, and was not reasonably controllable or preventable. EPA has also determined that the MassDEP has satisfied the procedural requirements for data exclusion. Therefore, EPA is "concurring" with MassDEP's claim that the exceedances at the Chicopee and Ware monitoring locations on May 25 and 26, 2016 were the result of an exceptional event.