ENCLOSURE: TECHNICAL SUPPORT DOCUMENT FOR EPA CONCURRENCE ON OZONE EXCEEDANCES MEASURED IN CONNECTICUT ON MAY 25 AND 26, 2016 AS EXCEPTIONAL EVENTS

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 September 28, 2016, the Connecticut Department of Energy and Environmental Protection (CT DEEP) submitted an Initial Notification of Potential Exceptional Event for elevated ozone concentrations at multiple monitoring stations in Connecticut on May 25 through 29, 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 initial area designations for the 2015 8-hour O_3 NAAQS and attainment of the 1997 8-hour O_3 NAAQS, and worked with CT DEEP to identify the relevant exceedances and monitoring sites affected.

On May 23, 2017, CT DEEP submitted an exceptional event demonstration for eight exceedances of 8-hour O_3 NAAQS, that occurred at the Abington, Cornwall, East Hartford, and Westport monitoring locations in Connecticut on May 25 and 26, 2016. The O_3 concentrations exceeded the 2015 O_3 NAAQS at all four of the monitoring locations, and in some cases exceeded the 1997 and 2008 O_3 NAAQS. Table 1 summarizes these exceedances.

In their demonstration, CT DEEP states that the elevated ozone measured on May 25 and 26, 2016 were influenced by 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 Connecticut. 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 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 mph. 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,

[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."

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	Abington	09-015-9991	0.076
May 25, 2016	Cornwall	09-005-0005	0.081
May 25, 2016	East Hartford	09-003-1003	0.075
May 25, 2016	Westport	09-001-9003	0.087
May 26, 2016	Abington	09-015-9991	0.083
May 26, 2016	Cornwall	09-005-0005	0.091
May 26, 2016	East Hartford	09-003-1003	0.093
May 26, 2016	Westport	09-001-9003	0.090

Narrative Conceptual Model

CT DEEP'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 Abington, Cornwall, East Hartford, and Westport monitoring locations and included additional information to support their claim.

In their discussion, CT DEEP included information for non-event characteristics in Connecticut, including a description of the four predominant scenarios of O_3 exceedances based on spatial patterns of measured O_3 and the contributing meteorological conditions. Specific to the observed event, CT DEEP described the classic State-wide exceedance scenario with surface wind flow from the southwest along the I-95 corridor, transport at mid-levels from the southwest via the lower-level nocturnal jet stream and flow at upper levels from the west. All of these flows are from emission-rich upwind areas, serving to transport O_3 precursors and previously formed O_3 into Connecticut. CT DEEP asserted the typically necessary meteorological conditions were not present to cause the magnitude of State-wide exceedances that were observed on May 25 and 26, 2016. Furthermore, the event began with winds originating from the normally clean air area to the northwest that typically results in low O_3 levels in Connecticut.

Because O_3 exceedance days in Connecticut are largely due to the transport of O_3 and O_3 precursors from upwind states, CT DEEP also provided information on regional nitrogen oxide (NO_X) and volatile organic compound (VOC) emissions, including source maps for NO_x and VOC emissions per square mile for the northeastern United States. The maps illustrate the predominant source of regional precursor emissions are southwest of Connecticut. In addition, CT DEEP included an analysis of NO_X emissions from upwind electric generating units (EGUs) to demonstrate that the exceedances on May 25 and 26 cannot be attributed, at least in part, to EGUs operating on high electric demand days as is more typically the case later in the O_3 season.

CT DEEP provided information on the vast size of the Ft. McMurray fire from media reports and described how the O_3 and O_3 precursors from biomass burning can impact O_3 concentrations far

away. Wildfire smoke plumes contain gases including non-methane hydrocarbons, carbon monoxide (CO), NO_X, and aerosols, which are all important precursors to the photochemical production of tropospheric O_3, and can travel for thousands of kilometers. Multiple factors such as fuel, plume path, and distance affect the intensity of the fire and its ability to enhance O_3 production downwind. CT DEEP contends that the unusually hot dry spring and fire intensity may have allowed the fire to burn and smolder deeper into the forest floor and added considerable emissions to plume. CT DEEP explained that emissions from wildfires can be transported long distances over several days and produce substantially higher O_3 concentrations in downwind locations.

CT DEEP's demonstration stated that the proposed data exclusion has regulatory significance with respect to the 1997 8-hour O_3 NAAQS for the Westport monitor, the 2008 8-hour O_3 NAAQS for the Cornwall and East Hartford monitors, and the initial 2015 8-hour O_3 NAAQS attainment/nonattainment area designations for the Abington monitor. CT DEEP summarized the event and included several data analyses to show evidence that smoke was transported from the Ft. McMurray fire into Connecticut and impacted ground-level monitors.

Based on the information described above, CT DEEP'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. (pages 7 – 18)	Sufficient	Yes
May 26, 2016	Section 2. (pages 7 – 18)	Sufficient	Yes

Clear Causal Relationship and Supporting Analyses

CT DEEP'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

CT DEEP included a comparison of historical concentrations, as required by 40 CFR §50.14(c)(3)(iv)(C). CT DEEP 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 5 years for the Abington and Cornwall monitoring locations on May 25 and for all four of the monitors on May 26. CT DEEP also applied a filter of 925 millibars (mb) sounding height to historical ozone data to filter days with similar wind patterns from the northwest. When the filter was applied, most of the O_3 exceedances above 70 parts per billion (ppb) for O_3 are removed from the data set, indicating that elevated O_3 is not typically observed in Connecticut under the wind conditions at the time of the event. Although the impact of sea breeze for the Westport monitoring location makes it difficult to apply this filter to that location, the analysis shows that elevated O_3 is typically not observed this early in the O_3 season at any of the monitors, especially with a predominantly northwest wind direction.

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 in Connecticut 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 similar in magnitude 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, CT DEEP evaluated the Tier 2 Key Factors in Section 2.6 and 4.3 of the demonstration. For Tier 2 Key Factor 1, CT DEEP provided an analysis of fire emissions (Q) and distance (D) of the wildfires 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 US 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. Therefore, the event exceedances do not meet Tier 2 Key Factor 1.

For Tier 2, Key Factor 2, CT DEEP compared the event-related O_3 concentrations with historical data for the April – September O_3 season over the past five years. CT DEEP's analysis determined the maximum daily 8-hour O_3 concentration met or exceeded the 99th percentile for observed data at the Abington and Cornwall monitoring locations on May 25 and for all four of the monitors on May 26. Therefore, all four of the monitors meet the criteria for Tier 2 Key Factor 2 on May 26 and two of the monitors meet the criteria for May 25.

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, CT DEEP'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

CT DEEP provided trajectory analysis using the Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) model. The analysis included multiple 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 Pennsylvania and upstate New York before eventually moving into Connecticut. CT DEEP stated that weather conditions began trapping the smoke plume in a boundary layer over the Great Lakes region on May 20, and thus used May 18 as the beginning of a 120-hour forward-trajectory from Ft. McMurray at 1,000, 1,500, and 2,000 meter (m) altitudes. This trajectory is consistent with the Visible Infrared

Imaging Radiometer Suite (VIIRS) satellite image on May 18 that shows parts of the plume heading east over the Hudson Bay on its way to Michigan a few days later. Once over the Great Lakes region, a high-pressure system formed on May 21 that trapped pollutants and led to O_3 production that peaked on May 24 in Michigan before moving east toward Connecticut.

CT DEEP continued their trajectory analysis by providing 48-hour back-trajectories from Michigan. These back-trajectories also showed plume movement from Ft. McMurray into Michigan and settling over the area for a few days. A matrix of 48-hour back-trajectories ending at 1,000 m over western New England was also provided for May 25 and 26, showing Michigan as the source region preceding the event. CT DEEP included O_3 Air Quality Index (AQI) maps for Michigan on May 23 and May 24 as supporting documentation of observed O_3 concentrations. CT DEEP 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 Connecticut.

Because surface winds at the Westport monitor often blow from the southwest due to afternoon sea breeze, CT DEEP included additional 168-hour back-trajectories from the Westport monitor demonstrating that the smoke plume from the Ft. McMurray fire was transported to Westport at a height of 3,000 m. Low-level back-trajectories at 100 m show winds starting from the northwest in the morning of May 25, but shifting to the southwest as a result of sea breeze influence. The analysis showed that although by 4:00 pm winds were travelling from the southwest, the wind direction during the morning was from the northwest and there would have been little time for significant O_3 enhancement from the I-95 corridor.

CT DEEP provided an analysis of synoptic scale meteorological features using weather maps from May 23 through 26 that were consistent with transport of emissions from the Upper Great Lakes region to New England. CT DEEP also provided satellite imagery to show the movement of visible smoke from Ft. McMurray to Connecticut. The progression of smoke plumes over North America during the event was further illustrated with satellite data using the Hazard Mapping System (HMS), elevated Carbon Monoxide (CO) plume maps, and maps of increased Aerosol Optical Depth (AOD) measurements associated with wildfire particulate matter (PM).

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. CT DEEP provided data of elevated hourly $PM_{2.5}$ measurements at the monitors, as well as webcam images of haze moving into Connecticut during the event.

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 Connecticut on both exceedance days.

<u>Evidence that the wildfire emissions affected the monitors and caused O_3 exceedances</u>
CT DEEP'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 fine particle ($PM_{2.5}$) monitoring data from Connecticut monitors that shows a clear elevated trend during the event, likely due to the influence of smoke in the area. CT DEEP also operates an aerosol backscatter ceilometer at the New Haven monitoring site, which is capable of providing backscatter plots up to 4,000 m. Aerosol backscatter plots during the event show an unusually dense region of aerosols reaching a height a 3,000 m that coincides with the increase of monitored $PM_{2.5}$ measurements and the arrival of the smoke plume over Connecticut on May 25.

Ground level monitors also showed spikes in the concentrations of other monitored parameters indicative of smoke such as black carbon (BC), CO, and DeltaC. When data was not available for one of the requested monitors, data from the nearest monitor and/or upwind monitor with this information was provided. DeltaC is the difference between 370 and 880 Aethalometer measurements (in $\mu g/m^3$), and is a semi-quantitative indicator of biomass combustion specific to wood smoke.[4] The data analysis shows large upward spikes of DeltaC starting on May 25 and an increase in BC base levels together with increased hourly deviations. CO base levels also trend upward with increases on the order of 50% from the previous four days. CT DEEP states that all of these trends are consistent with what would be expected from a distant smoke plume.

The demonstration also contained a discussion of the meteorological conditions present during the event. CT DEEP explained how a strong high-pressure front over the Great Lakes early in the event likely trapped pollutants from the wildfire and transported them to Connecticut as the high-pressure front moved eastward and eventually off the east coast. The analysis of 850 millibar (mb) height maps shows that by May 25, air flow loops around from Michigan and turns southeast toward New York and Connecticut. By May 26, the transported boundary layer air flows up from the Ohio River Valley before turning east-southeast in Connecticut. After this, the upper-level flow became more southwest like a typical transport scenario. Therefore, the weather patterns on May 25 and 26 did not fit any previous typical O_3 scenario, and absent the wildfire plume, would lead to cleaner air coming into the region.

Additionally, CT DEEP compared hourly O_3 concentrations to surface wind and temperature measurements at each site. Temperature measurements at all sites were conducive to O_3 formation during the event. Wind direction began from the west/northwest at the inland sites on May 25, but changed to the south at the Westport monitoring station due to sea breeze influence. All sites showed the surface wind direction changing to the south as the cold front approached from the north on May 27. Typically, southerly winds off the ocean transport clean maritime air into the state that pushes the O_3 plume north while lower observed concentrations. However, CT DEEP stated that higher O_3 was observed on May 27 at Cornwall indicating the smoke plume over the eastern seaboard was pushed inland.

Wind direction and weather patterns were also discussed regarding the HYSPLIT trajectories, and the movement of air masses from the Great Lakes region to Connecticut. Typically, these upwind locations are relatively low in O_3 and O_3 precursor emissions and similar meteorological conditions do not produce elevated levels of O_3 in Connecticut. CT DEEP further illustrated this

[4] Allen GA, Babich P, Poirot RL (2004) Evaluation of a new approach for real time assessment of woodsmoke PM. In "Proceedings of the Regional and Global Perspectives on Haze: Causes, Consequences and Controversies", Paper #16, Air and Waste Management Association Visibility Specialty Conference, Asheville, NC.

by providing a similar-day analysis for five days during the O_3 season over the last five years. Because surface wind direction and high temperature alone are not indicative of O_3 events, meteorologically similar days were identified using 850 mb pressure and wind patterns. CT DEEP chose days with similar HYSPLIT back-trajectories and wind speeds observed during the event. On all five of the similar days identified, O_3 levels were in the good to moderate range as opposed to the elevated levels observed during the event. (See pages 90-96 of CT DEEP's Demonstration.) The analysis supported CT DEEP's claim that elevated O_3 concentrations are not observed with similar meteorological conditions to those observed during the event.

CT DEEP 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 include gaseous wildfire emissions, which would include O_3 precursors, but otherwise is typically a reliable tool for air quality forecasting. Before the event, model predictions are near observed O_3 concentrations. However, the model shows a strong negative bias for May 25 and 26 during daytime hours, under-predicting peak O_3 concentrations by as much as 30 ppb during the event. The strength of this bias on a such a large area suggests the magnitude of the impact that the smoke plume likely had on the region.

CT DEEP stated that the evidence presented demonstrates "weather conditions in the northeastern United States were not conducive to O_3 formation as the event initiated on May 24 and 25 and although conditions became more favorable for O_3 formation after May 25, it is evident from our analysis that the wildfire plume had a significant effect on the O_3 levels for several days."

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, aerosol backscatter 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 the comparison of observed concentrations to predictions with NOAA CMAQ, sufficiently demonstrate a clear causal relationship between the emissions generated by the Ft. McMurray wildfire and the exceedances measured at the Abington, Cornwall, East Hartford, and Westport 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 2 – 8 (pages 7-101)	Sufficient	Yes
May 26, 2016	Sections 2 – 8 (pages 7-101)	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)]. CT DEEP'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 2.4 (pages 12-13)	Sufficient	Yes
May 26, 2016	Section 2.4 (pages 12-13)	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." CT DEEP 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 in Connecticut 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). CT DEEP 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 2.4 (pages 12-13)	Sufficient	Yes
May 26, 2016	Section 2.4 (pages 12-13)	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)	See website at www.ct.gov/deep/cwp/view.asp?A=4808&Q=581040	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)	Section 1: pages 1-2	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)	Cover Letter to Submittal	Yes. CT DEEP 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 CT DEEP to support claims that smoke from wildfires in Alberta, Canada contributed to exceedances of the 8-hour O_3 NAAQS at the Abington, Cornwall, East Hartford, and Westport monitoring locations on May 25 and 26, 2016. The O_3 concentrations exceeded the 2015 O_3 NAAQS at all four 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 CT DEEP has satisfied the procedural requirements for data exclusion. Therefore, EPA is "concurring" with CT DEEP's claim that the exceedances at these four locations on May 25 and 26, 2016 were the result of an exceptional event.