UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1
5 POST OFFICE SQUARE, SUITE 100
BOSTON, MA 02109-3912

SEP 1 9 2017

Janet Coit, Director
Department of Environmental Management
235 Promenade Street, Room 230
Providence, Rhode Island 02908

RE: Rhode Island Exceptional Event Demonstration for May 25-26, 2016

Dear Director Coit:

On June 20, 2017, the Rhode Island Department of Environmental Management (RI DEM) submitted an exceptional event demonstration claiming that emissions from the 2016 Fort McMurray wildfire caused elevated ozone levels in Rhode Island which exceeded the 8-hour Ozone National Ambient Air Quality Standards (NAAQS) at the East Providence, West Greenwich, and Narragansett 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.

RIDEM'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 RI DEM has made the demonstrations referred to in 40 CFR 50.14(a)(2), (b)(1) and (b)(4). In addition, RI DEM 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 RI DEM to demonstrate that the exceedances identified in the submitted demonstration for the dates of May 25 and 26, 2016, at the East Providence, West Greenwich, and Narragansett 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 East Providence, West Greenwich, and Narragansett 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: Laurie Grandchamp, RI DEM
Darren Austin, RI DEM

ENCLOSURE: TECHNICAL SUPPORT DOCUMENT FOR EPA CONCURRENCE ON OZONE EXCEEDANCES MEASURED IN RHODE ISLAND 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 January 9th, 2017, the Rhode Island Department of Environmental Management (RI DEM) Office of Air Resources submitted an Initial Notification of Potential Exceptional Event for elevated O_3 concentrations at three monitoring stations in Rhode Island 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 RI DEM to identify the relevant exceedances and monitoring sites affected.

On June 20th, 2017, RI DEM submitted an exceptional event demonstration for six exceedances of 8-hour O_3 NAAQS, that occurred at the East Providence, Narragansett, and West Greenwich monitoring locations in Rhode Island on May 25 and 26, 2016. The O_3 concentrations exceeded the 2015 O_3 NAAQS at all three of the monitoring locations, and in some cases exceeded the 1997 and 2008 O_3 NAAQS.[4] Table 1 summarizes these exceedances.

In their demonstration, RI DEM states that the elevated O_3 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

[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).

plume from a wildfire in the Ft. McMurray area of Alberta, Canada into Rhode Island. 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 was 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 northeastern U.S.

Table 1: 8-hour O_3 Exceedance Summary

Exceedance Date	Monitor/Site Name	AQS ID	8-hour Avg. (ppm)
May 25, 2016	East Providence	44-007-1010	0.071
May 25, 2016	Narragansett	44-009-0007	0.086
May 25, 2016	West Greenwich	44-003-0002	0.078
May 26, 2016	East Providence	44-007-1010	0.078
May 26, 2016	Narragansett	44-009-0007	0.081
May 26, 2016	West Greenwich	44-003-0002	0.084

Narrative Conceptual Model

RI DEM'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 East Providence, Narragansett, and West Greenwich monitoring locations and included additional information to support their claim.

RI DEM provided an in-depth discussion on the relationship between wildfire smoke, O_3 precursors, and elevated O_3 levels, and how the O_3 and O_3 precursors from biomass burning can impact O_3 concentrations immediately downwind of a fire and after long-range smoke transport. Multiple factors such as fuel, combustion efficiency, and available solar radiation affect the fire's ability to enhance O_3 production downwind. Wildfire smoke plumes contain gases including non-methane hydrocarbons, NO_X, and VOCs, which are all important precursors to the photochemical production of tropospheric O_3.

RI DEM explained that the unusually hot dry spring may have allowed the fire to reach the extreme conditions it did. RI DEM then used smoke modeling software, as well as visual satellite data and aerosol optical depth (AOD) data, to illustrate how the smoke plume from the fire traveled to Rhode Island via the Upper Midwest and Great Lakes Region. This information was corroborated with daily Air Quality Index (AQI) maps which showed elevated O_3 levels corresponding to the plume's movements eastward across the north-central U.S.

In their discussion, RI DEM included information for non-event characteristics in Rhode Island, including a description of the most common scenarios associated with O_3 exceedances. RI DEM described the classic State-wide exceedance scenario as very high temperatures with surface flow

along the I-95 corridor from more densely populated and industrialized precursor pollution source regions of Connecticut, New York, New Jersey, eastern Pennsylvania, and even into the Mid-Atlantic states via a generally southwest or west-southwest low-level component. Mid-level transport is also from the southwest or west-southwest, with a more westerly component in the upper levels. On May 25th, the trajectories rotated from northeast to north and by late morning northwest at mid and upper levels, while surface flows had rotated to the southwest from the west and northwest of the area (where the well-established smoke plume had been lingering) thus transporting the plume into Rhode Island's air shed. The demonstration shows that by 5:00 pm EST on May 26th, the exceptional event did begin to take on some characteristics of a traditional non-event day of O_3 exceedances with wind flow from the southwest, but by that time, the region was already under the influence of the significant smoke plume.

A common contribution to high O_3 days in Rhode Island are NO_x emissions from electric generating units (EGUs). EGU emissions are highest on hot, humid summer days as more electricity is used by households and businesses to power air conditioners. The Connecticut Department of Energy and Environmental Protection (CT DEEP) evaluated the emissions from May through September 2016 for the closest upwind states and found that the peak NO_x emissions from electric demand did not occur until later in the O_3 season and therefore NOx emissions from EGUs were likely not significantly contributing to the exceedances on May 25 and 26. Since Rhode Island is located downwind of Connecticut and downwind of typical flow patterns during high O_3 events, the analysis done by CT DEEP is applicable to Rhode Island as well.

RI DEM's demonstration indicated that the proposed data exclusion may have regulatory significance for future year design values because the current design value is at or near the 2015 O_3 NAAQS for the three monitors. 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 East Providence monitor.

RI DEM summarized the event and included several data analyses to show evidence that smoke was transported from the Ft. McMurray fire into Rhode Island and impacted ground-level monitors. Based on the information described above, RI DEM'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	Sections IV-VI, VIII-IX (pages 17 – 24, 25-29)	Sufficient	Yes
May 26, 2016	Sections IV-VI, VIII-IX (pages 17 – 24, 25-29)	Sufficient	Yes

Clear Causal Relationship and Supporting Analyses

RI DEM'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

RI DEM included a comparison of historical concentrations, as required by 40 CFR §50.14(c)(3)(iv)(C). RI DEM 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 Narragansett and West Greenwich monitoring locations on May 25 and for all three of the monitors on May 26. RI DEM also showed that the daily 8-hour maximum O_3 concentrations observed at Narragansett and West Greenwich on May 25 and all three monitors on May 26 were above the fourth highest value for each site during 2016. In addition, the daily 8-hour maximum O_3 concentrations at Narragansett and West Greenwich on May 25 were among the three highest values recorded during the most recent six-year O_3 season history (April 1 – September 30).

Tier 1: Key Factor

To meet the key factor for a Tier 1 analysis, exceedances should be clearly higher than other, non-event related exceedances, or occur during a time of year that typically experiences no exceedances. The event-related exceedances identified in this demonstration occurred during the regular O_3 season. Although statistically abnormal for that time of year, exceedances during this timeframe of similar magnitude are not unprecedented and do occur. 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, RI DEM evaluated the Tier 2 Key Factors in Attachment II and Section 3 of the demonstration. For Tier 2 Key Factor 1, RI DEM relied upon an analysis performed by the CT DEEP in their exceptional events demonstration for the same event and days. Included in the demonstration as Attachment II, 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. This analysis is applicable to the East Providence, Narragansett, and West Greenwich monitoring locations because the distances are similar to those used in the analysis by CT DEEP. Therefore, the event exceedances do not meet Tier 2 Key Factor 1.

For Tier 2, Key Factor 2, RI DEM 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, RI DEM's analysis determined the maximum daily 8-hour O_3 concentration exceeded the 99th percentile for observed data at Narragansett and West Greenwich monitoring locations on May 25 and for all three of the monitors on May 26. In addition, the daily 8-hour maximum O_3 concentrations observed at Narragansett and West Greenwich on May 25 and all three monitors on May 26 were above the fourth highest value for each site during 2016. The daily 8-hour maximum O_3 concentrations at Narragansett and West Greenwich on May 25 were also among

the three highest values recorded during the most recent six-year O_3 season history. Therefore, all three 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, RI DEM'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

RI DEM provided trajectory analysis using the Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) model. The analysis used 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 upstate New York before eventually moving into Rhode Island. The demonstration described the movement of daily air masses relevant to the smoke plume from May 18 through the arrival in New England on May 25. RI DEM included a 120-hour forward-trajectory starting on May 18 at the 1000 meter (m), 1500 m, and 3000 m above ground level to clearly show that parcels of the smoke plume would likely have been transported from the wildfire to the Great Lakes region and Michigan, arriving on or about May 21. RI DEM noted that with surface high pressure over the Great Lakes region, pollutants within these parcels would have become trapped due to the light winds and limited mixing conditions associated with the high-pressure system. Because the uncertainty of trajectory analysis increases with transport distance, frontal passages, and complex wind or terrain issues, the demonstration also included forward- and backward-trajectories from Seney, Michigan and East Syracuse, New York that illustrate the continued movement of air masses from the wildfire into New England. These trajectories are consistent with visible smoke from NASA satellite imagery included in the demonstration and also show some stagnation at the surface that aligns with the presence of surface high-pressure over Michigan on May 21.

RI DEM continued their trajectory analysis by providing localized 36-hour back-trajectories from each of the monitoring locations. The trajectories show that the flows on May 25 were atypical of high O_3 events and originate along a course with which the smoke plume was traveling. RI DEM explains that although the trajectories during the evening of May 26 began to take on characteristics of a more typical O_3 event with favorable transport from the southwest, the smoke and O_3 plume was well entrenched and continued to enhance O_3 production. Other data provided by RI DEM in their demonstration supports the presence of the smoke plume on May 26.

To further support the movement of smoke plume to ground-level monitors, RI DEM included an analysis from the CT DEEP's demonstration for organic carbon (OC) and potassium (K) species concentrations from upwind monitors in New York and Michigan. This analysis, included as Attachment V, shows elevated OC and K levels associated with wildfire emissions corresponding with elevated O_3 levels observed at ground-level as the smoke plume moved into the upper Great Lakes region and eastward toward Rhode Island.

RI DEM also provided an analysis of surface weather maps from May 18 through 26 that were consistent with transport of emissions from the Upper Great Lakes region to New England. The analysis shows that on May 25 the surface winds originate from the well-established smoke plume lingering to the west of northwest of the Rhode Island airshed. On the afternoon of May 26, the wind direction at the upper level boundary height of 850 mb shifted to the southwest while surface wind direction at the 500 mb height exhibited a more westerly origin, which is consistent with the trajectory analysis. RI DEM 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) and satellite maps of increased Aerosol Optical Depth (AOD) measurements associated with suspended particulates from wildfires.

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. RI DEM provided data of elevated hourly fine particulate ($PM_{2.5}$), carbon monoxide (CO), and black carbon (BC) measurements at the monitors, as well as webcam images of haze moving into the region 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 Rhode Island on both exceedance days.

Evidence that the wildfire emissions affected the monitors and caused O_3 exceedances

RI DEM'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 $PM_{2.5}$ monitoring data from Rhode Island monitors that shows a clear elevated trend during the event, likely due to the influence of smoke in the area. Ground-level monitors also showed spikes in the concentrations of other monitored parameters indicative of smoke such as BC and CO. 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. The data analysis shows a significant upward trend from pre-event baseline readings, indicative of a smoke plume interacting with the surface. The peaks of each parameter coincide well with each other, and also match the timing of the peak O_3 concentrations and other analyses demonstrating the arrival of the plume into Rhode Island. RI DEM also noted that high $PM_{2.5}$ and BC measurements typically build incrementally over time, but on May 25 the levels of these pollutants increased very rapidly as the smoke plume moved into the area. RI DEM states that all of these trends are consistent with what would be expected from a distant smoke plume arriving locally.

The demonstration also included an analysis of OC and K data from the East Providence monitoring site. Although the sample days captured at the site did not include May 25 and May 26, the data shows that May 24 is reflective of relatively clean air prior to the event while May 27 has elevated levels of OC and K that coincide with elevated O_3 concentrations.

RI DEM states that the May 25 and 26 time frame did not display meteorological conditions historically associated with high O_3 events. Specifically, there was not a period of stagnation

since an area of low pressure was situated just offshore. Typical O_3 exceedances exhibit a prolonged offshore Bermuda high pressure, and flows were at least initially unfavorable for exceptionally high O_3 measurements. RI DEM asserted that the trajectories for May 25 and 26 did not indicate the air mass was arriving from the typical transport and emissions rich source regions to the west and south and the temperature during the event was much lower than typical high O_3 events. As a result, the scale and magnitude of the O_3 concentrations during the May 25 and 26 were likely due to the presence of wildfire smoke.

RI DEM further illustrated this by providing an analysis of the meteorological conditions present during typical high O_3 events, using examples of several non-event O_3 exceedance days. These days are characterized by high temperatures and winds from the southwest or west-southwest. In the analysis, RI DEM demonstrated that typical wind directions, weather patterns, and temperatures associated with non-event O_3 exceedance days were not present on May 25 and 26. RI DEM also conducted a matching-day analysis, which examined several other days from the 2016 O_3 season with similar 36-hour back-trajectories and weather patterns to those of May 25 and 26 but with no smoke influence. The chosen days had high temperatures, above 90 degrees Fahrenheit, and were characterized by trajectories from the northwest or west-northwest, either clear or partly cloudy skies, and no precipitation. In all cases, the O_3 levels on these days were below the O_3 NAAQS, and in most cases far below, demonstrating the impact of the smoke plume during the event.

RI DEM 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. The negative bias in the model for Rhode Island reaches approximately 15-25 pbb on May 25 and 26, but becomes more neutral on May 27 as the smoke impact lessened. RI DEM states that by that time the weather pattern and trajectories indicate a more southerly, cleaner flow which likely displaced some of the plume out of the region. Because the model does not assimilate gaseous wildfire emissions in predicting O_3 concentrations, the large negative bias was likely due to wildfire smoke at the monitors.

In their conclusion, RI DEM stated that the evidence presented in the demonstration "revealed that weather conditions were not favorably for O_3 formation as the event unfolded on May 25, lasting into May 26, 2016 and that the smoke plume had a significant effect on O_3 readings for those days".

The analyses in the demonstration, specifically, the comparison with historical O_3 8-hour maximum concentrations and percentile analysis, trajectory 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, 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 model, sufficiently demonstrate a clear causal relationship between the emissions generated by the Ft. McMurray wildfire and the exceedances measured at the East Providence, Narragansett, and West Greenwich 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 III – XIV (pages 11 - 40) and Attachment II, IV, and V	Sufficient	Yes
May 26, 2016	Sections III – XIV (pages 11 - 40) and Attachment II, IV, and V	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)]. RI DEM'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 XVI (pages 42-43)	Sufficient	Yes
May 26, 2016	Section XVI (pages 42-43)	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." RI DEM 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 Rhode Island 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). Rhode Island 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 XV (pages 40 - 42)	Sufficient	Yes
May 26, 2016	Section XV (pages 40 - 42)	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)	Health Advisory Notification issued on May 25, 2016 was included as unspecified attachment.	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)	Section XVIII and Attachment 1: pages 47-50	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)	Section XVIII: pages 44-46	Yes. RI DEM received comments from EPA Region 1 during the public comment period. The comments were adequately addressed in the final 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 RI DEM to support claims that smoke from wildfires in Alberta, Canada contributed to exceedances of the 8-hour O_3 NAAQS at the East Providence, Narragansett, and West Greenwich monitoring locations on May 25 and 26, 2016. The O_3 concentrations exceeded the 2015 O_3 NAAQS at all three 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 RI DEM has satisfied the procedural requirements for data exclusion. Therefore, EPA is "concurring" with RI DEM's claim that the exceedances at these three locations on May 25 and 26, 2016 were the result of an exceptional event.