

**Technical Support Document for EPA Concurrence on O₃ Exceedances Measured
at Four Pennsylvania Monitors on May 25 and May 26, 2016 as Exceptional
Events**

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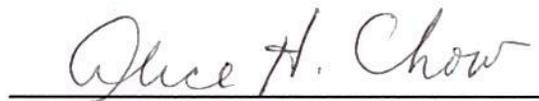
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Date Signed

- C. “Analyses comparing the claimed event-influenced concentration(s) to concentrations at the same monitoring site at other times” to support (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 EPA’s Air Quality System (AQS) as described in 40 CFR §50.14(c)(2)(i),
2. Completion and documentation of the public comment process described in 40 CFR §50.14(c)(3)(v), and
3. Implementation of any 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. We include below a summary of the Exceptional Events Rule criteria, including those identified in 40 CFR §50.14(c)(3)(iv).

Regulatory Significance

The 2016 Exceptional Events Rule includes regulatory language that applies the provisions of CAA section 319 to a specific set of regulatory actions. As identified in 40 CFR §50.14 (a)(1)(i), these regulatory actions include initial area designations and redesignations; area classifications; attainment determinations (including clean data determinations); attainment date extensions; findings of State Implementation Plan (SIP) inadequacy leading to a SIP call; and other actions on a case-by-case basis as determined by the Administrator. Air agencies and EPA should discuss the regulatory significance of an exceptional events demonstration during the Initial Notification of Potential Exceptional Event prior to the air agency submitting a demonstration for EPA’s review.

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.”

- *Key Factor 1:* fire emissions and distance of fire(s) to affected monitoring site location(s). Calculated fire emissions of NO_x and reactive-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 ≥ 100 tpd/km). The guidance document provides additional information on the calculation of Q/D.
 - *Key Factor 2:* comparison of the event-related O₃ concentration with non-event related high O₃ concentrations. The exceedance due to the exceptional event:
 - Is in the 99th or higher percentile of the 5-year distribution of O₃ monitoring data, OR
 - Is one of the four highest O₃ 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 O₃ 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 O₃ exceedance.

Not Reasonably Controllable or Preventable

The Exceptional Events Rule requires that air agencies establish that the event be both not reasonably controllable and not reasonably preventable at the time the event occurred. This requirement applies to both natural events and events caused by human activities; however, it is presumed that wildfires on wildland will satisfy both factors of the “not reasonably controllable or preventable” element unless evidence in the record clearly demonstrates otherwise.²

² 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.”

and 27 exceedances of the 2015 8-hour O₃ standard that occurred at the following monitors:

- Lebanon (AQS: 420750100) – May 26, 2016
- Norristown (AQS: 420910013) – May 26, 2016
- Kittanning (AQS: 42005001) – May 25, 2016
- Hookstown (AQS: 420070002) – May 25, 2016
- Beaver Falls (AQS: 420070014) – May 25, 2016
- Kutztown (AQS: 420110006) – May 25, 2016
- Altoona (AQS: 420130801) – May 25, 2016
- New Garden (AQS: 420290100) – May 26, 2016
- Hershey (AQS: 420431100) – May 25, 2016
- Chester (AQS: 420450002) – May 26, 2016
- Strongstown (AQS: 420630004) – May 24 and May 25, 2016
- Peckville (AQS: 420690101) – May 26, 2016
- Scranton (AQS: 420692006) – May 25, 2016
- Lancaster Downwind (AQS: 420710012) – May 25, 2016
- Allentown (AQS: 420770004) – May 26, 2016
- Montoursville (AQS: 420810100) – May 25, 2016
- Farrell (AQS: 420850100) – May 24, 2016
- Swiftwater (AQS: 420890002) – May 26, 2016
- Freemansburg (AQS: 420950025) – May 26, 2016
- Easton (AQS: 420958000) – May 26, 2016
- Northeast Waste (AQS: 421010048) – May 26, 2016
- Tioga County (AQS: 421174000) – May 24 and 25, 2016
- Florence (AQS: 421255001) – May 25, 2016
- York (AQS: 421330008) – May 25, 2016
- York Downwind (AQS: 421330011) – May 25, 2016

The same monitored exceedances were included in PADEP's final demonstration dated February 20, 2018.

Regulatory Significance

EPA worked with PADEP to identify the relevant exceedances and monitoring sites affected. Ultimately, monitor days without exceedances, or immediate or possible regulatory significance requested by PADEP were either deferred or non-concurred. Table 1 summarizes the monitor days with exceedances and EPA's decisions.

05/25/2016	Altoona	420130801	71	Non-concur
05/25/2016	State College	420270100	77	Non-concur
05/25/2016	Moshannon	420334000	76	Non-concur
05/26/2016	Reading Airport	420110011	76	Concur
05/26/2016	Lebanon	420750100	72	Concur
05/26/2016	Norristown	420910013	74	Concur
05/26/2016	Freemansburg	420950025	75	Concur
05/26/2016	Bristol	420170012	81	Defer
05/26/2016	New Garden	420290100	73	Defer
05/26/2016	Chester	420450002	71	Defer
05/26/2016	Peckville	420690101	73	Defer
05/26/2016	Lancaster	420710007	80	Defer
05/26/2016	Allentown	420770004	73	Defer
05/26/2016	Swiftwater	420890002	72	Defer
05/26/2016	Easton	420958000	74	Defer
05/26/2016	Northeast Airport	421010024	79	Defer
05/26/2016	Northeast Waste	421010048	71	Defer
05/26/2016	York Downwind	421330011	80	Defer

Narrative Conceptual Model

PADEP's demonstration provided a narrative conceptual model to describe how emissions from Fort McMurray, Alberta, Canada contributed to O₃ exceedances at the Reading Airport, Lebanon, Norristown, and Freemansburg monitoring stations. The conceptual model included a general overview of the emissions and meteorology typically conducive to O₃ formation in Pennsylvania, a literature review of studies that examine the role of wildfires on downwind O₃, and a discussion of the meteorology, wildfire smoke, and regional, ground-level O₃ on the days leading up to, and during, the exceptional event.

In the demonstration, PADEP explains that, "Pennsylvania is a part of the Ozone Transfer Region (OTR)", and that, "Peak ozone concentrations are not only a factor of existing meteorological conditions; peak ozone concentrations are reliant on regional and local emission loading on any given day". Due to nitrogen oxide (NO_x) emissions reduction efforts across the OTR, Pennsylvania has seen significant decreases in the number of days with exceedances of the 2008 and 2015 O₃ NAAQS.

During May and June of 2016, the Fort McMurray wildfire covered over 1,500,000 acres of land. In the days leading up to the exceptional event-associated O₃ NAAQS exceedances in Pennsylvania, "the upper level winds, which steer the weather patterns across the world, were conducive to funneling smoke that was aloft south and east across northcentral US into the

Comparison of Event O₃ Concentrations with Non-event

Of the 127 monitor days requested for exclusion, all but three (where exceedances of the 2008 or 2015 NAAQS occurred) recorded maximum 8-hour O₃ concentrations that were within the top four highest for 2016 at that monitor. Additionally, the four monitors that were concurred with, had daily maximum 8-hour O₃ concentrations during the event dates that were at, above, or just below the 99th percentile for the years 2012-2016.

Concentrations of Supporting Ground-level Measurements

Ground-level concentrations of PM_{2.5} from several monitors across Pennsylvania increased sharply during the event period. PADEP reports that the Erie monitor, located in northwestern PA, was the first to respond to the event with concentrations rising on May 23. The western and northcentral monitors rose on May 24, and as the air mass continued to track southeast, the southcentral and southeastern monitors responded to the airmass on May 25.

PADEP utilized PM_{2.5} speciation data from Great Lakes and Ohio Valley states on May 24 to investigate the presence and change in concentrations of wildfire tracers (organic carbon and potassium ion). Both organic carbon and potassium ion concentrations peaked on May 24. PADEP writes, "For many of the sites, the organic carbon concentrations measured on May 24 was the highest for the entire month of May 2016". Presence of these wildfire tracers indicate that the airmass has likely been influenced by wildfire and provides evidence for connecting the elevated PM_{2.5} concentrations discussed above with the Ft. McMurray wildfire.

Similar Day Analysis

PADEP identified two days (May 26, 2014 and May 4, 2015) between 2012 and 2016 with similar meteorology to the event dates (temperatures around 80°F, winds from the northwest, and high pressure near the Mid-Atlantic). Overall, lower O₃ concentrations were recorded on the similar days. PADEP states that on the similar days, "there was not one monitor in Pennsylvania which exceeded the 2015 ozone NAAQS".

Photochemical Model

The Community Multi-Scale Air Quality (CMAQ) O₃ model can predict quantitatively and spatially O₃ concentrations. In 2016 when MDE ran CMAQ in support of their 2016 Ft. McMurray wildfire exceptional event demonstration, the model did not include 2016 wildfire emissions in the O₃ chemical creation mechanism. Therefore, the model results could be compared with observed O₃ concentrations. If CMAQ significantly underpredicts daily maximum 8-hour O₃, it is indicative that there were O₃ sources that were not accounted for.

PADEP incorporated figures from an analysis performed by Joel Dreessen at MDE. These figures show an area of underpredicted maximum daily 8-hour O₃ in the Midwest on May 24, 2016. By May 25, the area of underprediction had spread east and across northern Pennsylvania, and by

Table 4. Documentation of not Reasonably Controllable or Preventable

Exceedance Date	Demonstration Citation	Quality of Evidence	Criterion Met?
May 24, 2016	Page 58	Sufficient	Yes
May 25, 2016	Page 58	Sufficient	Yes
May 26, 2016	Page 58	Sufficient	Yes

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

The definition of “wildfire” at 40 CFR §50.1(n) states, “A wildfire that predominantly occurs on wildland is a natural event.” PADEP’s demonstration included documentation that the event met the definition of a wildfire and occurred predominantly on wildland. PADEP has therefore shown that the event was a natural event.

Table 5. Documentation of Natural Event

Exceedance Date	Demonstration Citation	Quality of Evidence	Criterion Met?
May 24, 2016	Page 58	Sufficient	Yes
May 25, 2016	Page 58	Sufficient	Yes
May 26, 2016	Page 58	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)	Page 58	Yes
Did the agency submit an Initial Notification of Potential Exceptional Event and flag the affected data	40 CFR §50.14 (c)(2)(i)	NA	Yes

Has the agency met requirements regarding submission of a mitigation plan, if applicable?	40 CFR §50.1930(b)	NA	NA
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Conclusion

EPA has reviewed the documentation provided by PADEP to support claims that smoke from wildfires in Fort McMurray, Alberta, Canada contributed to exceedances of the 2008 and/or 2015 8-hour O₃ standards at the Reading Airport, Lebanon, Norristown, and Freemansburg monitoring sites on May 25 and 26, 2016. 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 PADEP has satisfied the procedural requirements for data exclusion.