



REGION 5 ADMINISTRATOR

CHICAGO, IL 60604

July 24, 2025

Clint Woods
Commissioner
Indiana Department of Environmental Management
100 North Senate Avenue
Indianapolis, Indiana 46204

Dear Commissioner Woods:

The U.S. Environmental Protection Agency has reviewed the January 16 and February 6, 2025, letters from Matt Stuckey, Assistant Commissioner Office of Air Quality, requesting that the EPA concur with the Indiana Department of Environmental Management's exceptional events demonstrations for air quality monitoring sites in Evansville, Jeffersonville, Terre Haute, and South Bend. The EPA concurs with IDEM's demonstrations for the dates and locations listed below.

The EPA agrees that wildfires or fireworks caused exceedances of the 2024 annual PM_{2.5} National Ambient Air Quality Standard on several days, and that IDEM's demonstrations for these dates meet the Exceptional Events Rule criteria at 40 CFR Parts 50 and 51. In addition, the EPA finds that IDEM has met the schedule and procedural requirements in § 50.14(c). I have enclosed four technical support documents that explain the EPA's analysis of IDEM's demonstrations. My staff will enter "concurrence flags" for these data in the EPA's Air Quality System data repository.

Monitor Name	Date
Evansville – Buena Vista	June 14-16, 2022
Evansville – Buena Vista	July 22, 2022
Evansville – Buena Vista	June 4, 2023
Evansville – Buena Vista	June 6-10, 2023
Evansville – Buena Vista	June 16-18, 2023
Evansville – Buena Vista	June 27-29, 2023
Evansville – Buena Vista	July 4, 2023
Evansville – Buena Vista	September 7, 2023
Evansville – U of E	June 16, 2022
Evansville – U of E	July 22, 2022
Evansville – U of E	June 8, 2023
Evansville – U of E	July 4, 2023

Monitor Name	Date
Jeffersonville-Bates-Bowyer Ave	June 14-16, 2022
Jeffersonville-Bates-Bowyer Ave	June 3-4, 2023
Jeffersonville-Bates-Bowyer Ave	June 6-10, 2023
Jeffersonville-Bates-Bowyer Ave	June 15-18, 2023
Jeffersonville-Bates-Bowyer Ave	June 27-29, 2023
Jeffersonville-Bates-Bowyer Ave	July 4-5, 2023
Jeffersonville-Bates-Bowyer Ave	July 16-17, 2023
South Bend-Shields Dr	June 18, 2023
South Bend-Shields Dr	June 27-30, 2023
South Bend-Shields Dr	July 16, 2023
South Bend-Shields Dr	July 25, 2023
Terre Haute-Lafayette Avenue	June 14-15, 2022
Terre Haute-Lafayette Avenue	July 3, 2022
Terre Haute-Lafayette Avenue	June 5-7, 2023
Terre Haute-Lafayette Avenue	June 15, 2023
Terre Haute-Lafayette Avenue	June 17-18, 2023
Terre Haute-Lafayette Avenue	June 27-29, 2023
Terre Haute-Lafayette Avenue	July 4, 2023
Terre Haute-Lafayette Avenue	July 16-18, 2023

With the data adjustments noted above, each of these areas show attainment of the 2024 annual PM_{2.5} NAAQS for the 2022-2024 design value period.

At this time, the EPA is not taking action on the state's demonstrations for several days at the Evansville, Jeffersonville, and Terre Haute monitors, identified in the technical support documents, since adjustments are not needed to meet air quality standards. The EPA is committed to revisit these demonstrations if necessary for regulatory purposes in the future.

The EPA's concurrence is not a final agency action. If the EPA takes a regulatory action that is affected by the exclusion of this data, then the EPA will publish notice of its proposed action in the *Federal Register*. That regulatory action will serve as the final agency action subject to judicial review.

If you have any questions or wish to discuss this matter further, please contact me or have your staff contact John Mooney, Air and Radiation Division Director, at 312-886-6043.

Sincerely,

ANNE
VOGEL

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Date: 2025.07.24
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Anne Vogel
US EPA Region 5 Administrator
& Great Lakes National Program Manager

ENCLOSURES

1. Evansville Technical Support Document
2. Jeffersonville Technical Support Document
3. Terre Haute Technical Support Document
4. South Bend Technical Support Document

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TECHNICAL SUPPORT DOCUMENT FOR THE EPA'S CONCURRENCE ON PM_{2.5} EXCEEDANCES MEASURED IN EVANSVILLE, IN ON JUNE 14-16, 2022, JULY 22, 2022, JUNE 4, 2023, JUNE 6-10, 2023, JUNE 16-18, 2023, JUNE 27-29, 2023, JULY 4, 2023, AND SEPTEMBER 7, 2023, AS EXCEPTIONAL EVENTS

On January 22, 2025, the U.S. Environmental Protection Agency received the Indiana Department of Environmental Management's exceptional event demonstration, dated January 16, 2025. IDEM's exceptional event demonstration addresses exceedances of the 2024 annual particulate matter with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers National Ambient Air Quality Standards that occurred at the Evansville – Buena Vista (Air Quality System ID: 18-163-0021) monitoring site on June 14-16, 2022, July 22, 2022, June 4, 2023, June 6-10, 2023, June 16-18, 2023, June 27-29, 2023, July 4, 2023, and September 7, 2023, and Evansville – University of Evansville (AQS ID: 18-163-0016) monitoring site on June 16, 2022, July 22, 2022, June 8, 2023, and July 4, 2023. The demonstration submitted by IDEM states that the exceedances measured on these dates were caused by smoke entering the region from multiple wildfires in the U.S. and Canada or emissions from fireworks displays associated with the Fourth of July. Under the Exceptional Events Rule, air agencies can request the exclusion of event-influenced data, and the EPA can concur to exclude these data, from the data set used for certain regulatory decisions. The remainder of this document summarizes the EER requirements, the subject events and the EPA's review of IDEM's submitted exceptional events demonstration.

EXCEPTIONAL EVENTS RULE REQUIREMENTS

The EPA promulgated the current EER in 2016, pursuant to Clean Air Act § 319. The EER added § 50.1(j)-(r), 50.14, and 51.930 to Title 40 of the Code of Federal Regulations. These sections contain definitions, criteria for the EPA's approval, procedural requirements, and requirements for air agency demonstrations. The 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 the EER criteria for the EPA to concur with excluding the air quality data from regulatory decisions. If the demonstration is found to not have regulatory significance, the EPA may defer making a concurrence determination.

Under 40 CFR § 50.14(c)(3)(iv), the air agency's 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 (“initial notification”) and flagging of the affected data in the EPA's 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 EER criteria, including those identified in 40 CFR § 50.14(c)(3)(iv).

Regulatory Significance

The EER includes regulatory language that applies the provisions of CAA § 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 inadequacy leading to a SIP call; and other actions on a case-by-case basis as determined by the Administrator. Air agencies and the 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 the EPA's review.

Narrative Conceptual Model

The EER 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. Further, under 40 CFR § 50.14(a)(1)(i), the narrative conceptual model must describe the regulatory significance of the proposed data exclusion. For wildfire events, the EPA recommends that the narrative conceptual model also discuss emissions, meteorology, and pollutant transport. Air agencies may support the narrative conceptual model with summary tables or maps.

Clear Causal Relationship and Supporting Analyses

The EPA considers a variety of evidence when evaluating whether there is a clear causal relationship between a specific event and the monitored exceedance or violation. For wildfire PM_{2.5} events, air agencies should compare the PM_{2.5} data requested for exclusion with 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

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.”

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 PM_{2.5} exceedance or violation.

For wildfire PM_{2.5} events, the EPA has published the *PM_{2.5} Wildland Fire Exceptional Events Tiering Document* which provides three 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 the clear causal relationship for some wildfire events may be more explicit and/or extreme and, under the weight of evidence approach, may require relatively less evidence to satisfy the rule requirements.

To determine the tier for an event, the air agency will first determine the tiering threshold for the monitor day. The tiering thresholds are based on the lesser value of either (a) the most recent 5-year month specific 98th percentile for 24-hour PM_{2.5} data, or (b) the minimum annual 98th percentile for 24-hour PM_{2.5} data for the most recent 5-year period. In calculating both (a) and (b), all data with any "Request Exclusion" (R) or fire-related "Informational Only" (I) qualifiers are excluded when using the *PM_{2.5} Tiering Tool* available on the EPA's website. Air agencies are encouraged to evaluate their data carefully and consult with their EPA regional office about any data anomalies on a case-by-case basis. The EPA also retains its authority and discretion to evaluate data anomalies in submitted data and determine what tier is applicable for a candidate event.

- Tier 1:
 - **Key Factor for Tier 1 Analyses:** Distinct high levels of monitored 24-hour PM_{2.5} concentrations when compared to historical monthly or annual 24-hour levels of PM_{2.5}.
 - **Criteria:** Event-related exceedances should be greater than or equal to 1.5 times the tiering threshold as described for that candidate event day to be clearly distinguishable from non-event related concentrations.
 - In addition to the supporting analysis used to determine the Tier 1 criteria are met, the air agency should also supply at least one piece of additional evidence to support that the emissions from the fire were transported to the monitor location.
- Tier 2:
 - **Key Factor for Tier 2 Analyses:** High levels of monitored 24-hour PM_{2.5} concentrations, when compared to historical monthly or annual 24-hour levels of PM_{2.5}.
 - **Criteria:** Event-related exceedances are greater than or equal to the tiering threshold but less than 1.5 times the tiering threshold.
 - In addition to the evidence required for a Tier 1 analysis, the air agency should supply at least two additional pieces of evidence, one of which must be quantitative, to support a weight of evidence conclusion that it was the emissions from the wildfire, rather than other sources, that affected the monitored PM_{2.5} concentration.
- Tier 3:
 - **Key Factor for Tier 3 Analyses:** The relationship between the wildfire and the PM_{2.5} exceedance/violation is more complicated than the relationship in a Tier 2 analysis and thus would require more supporting documentation.
 - **Criteria:** Tier 3 demonstrations are appropriate when the measured 24-hour PM_{2.5} concentration is less than the tiering threshold and there are not any other extenuating circumstances or data anomalies that would point to a Tier 2 analysis being sufficient.

² See the EPA's *PM_{2.5} Wildland Fire Exceptional Events Tiering Document*, April 2024 (the EPA's PM_{2.5} Tiering Document).

- 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 PM_{2.5} exceedance.

Not Reasonably Controllable or Preventable

The EER 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 EER, an exceptional event must be “an event caused by human activity that is unlikely to recur at a particular location or a natural event.” The EER 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 would be needed 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.

THE EPA’S REVIEW OF EXCEPTIONAL EVENTS DEMONSTRATION

On November 8, 2024, IDEM submitted an Initial Notification of Potential Exceptional Events and on January 22, 2025, IDEM submitted an exceptional events demonstration, dated January 16, 2025. The demonstration is for 26 exceedances of the 2024 annual PM_{2.5} NAAQS but this TSD only evaluates those that occurred at the Evansville – Buena Vista (AQS ID: 18-163-0021) monitoring site on June 14-16, 2022, July 22, 2022, June 4, 2023, June 6-10, 2023, June 16-18, 2023, June 27-29, 2023, July 4, 2023, and September 7, 2023, and Evansville – U of E (AQS ID: 18-163-0016) monitoring site on June 16, 2022, July 22, 2022, June 8, 2023, and July 4, 2023, located within the Evansville, IN Core-Based Statistical Area.⁴ The EPA defers action on IDEM’s exceptional events requests for the Evansville – Buena Vista monitor on May 20, 2023, and August 23-24, 2023, and the Evansville – U of E monitor on August 24, 2023. The data for these days do not currently have regulatory significance and are lower concentrations.

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 See Indiana-PM_{2.5} Exceptional Events Initial Notification-Evansville.

Regulatory Significance

The EPA determined that exclusion of these exceedances of the PM_{2.5} standard have regulatory significance for initial area designations of the Evansville CBSA for the 2024 annual PM_{2.5} NAAQS and worked with IDEM to identify the relevant exceedances, monitoring sites affected, and tiers. Table 1 summarizes these exceedances.

Table 1: Summary of Data Requested for Exclusion⁵

Exceedance Date	Monitoring Site Name	AQS ID	Monitored Concentration (µg/m ³)	Tier
June 14, 2022	Evansville - Buena Vista	18-163-0021	27.5	1
June 15, 2022	Evansville - Buena Vista	18-163-0021	26.8	1
June 16, 2022	Evansville - Buena Vista	18-163-0021	21.6	1
June 16, 2022	Evansville - U of E	18-163-0016	23.7	1
July 22, 2022	Evansville - Buena Vista	18-163-0021	25.6	1
July 22, 2023	Evansville - U of E	18-163-0016	23	1 ⁶
June 4, 2023	Evansville - Buena Vista	18-163-0021	21.9	1
June 6, 2023	Evansville - Buena Vista	18-163-0021	27.5	1
June 7, 2023	Evansville - Buena Vista	18-163-0021	30.2	1
June 8, 2023	Evansville - Buena Vista	18-163-0021	29.7	1
June 8, 2023	Evansville - U of E	18-163-0016	24.6	1
June 9, 2023	Evansville - Buena Vista	18-163-0021	25.7	1
June 10, 2023	Evansville - Buena Vista	18-163-0021	22.4	1
June 16, 2023	Evansville - Buena Vista	18-163-0021	23.3	1
June 17, 2023	Evansville - Buena Vista	18-163-0021	21.1	1 ⁶
June 18, 2023	Evansville - Buena Vista	18-163-0021	23.7	1
June 27, 2023	Evansville - Buena Vista	18-163-0021	35.4	1
June 28, 2023	Evansville - Buena Vista	18-163-0021	94.1	1
June 29, 2023	Evansville - Buena Vista	18-163-0021	27.8	1
July 4, 2023	Evansville - Buena Vista	18-163-0021	27.2	1
July 4, 2023	Evansville - U of E	18-163-0016	19.5	1 ⁶
September 7, 2023	Evansville - Buena Vista	18-163-0021	23.1	1

Concurrence on the exceedances listed in Table 1 would result in changing the design value for Evansville - Buena Vista from 9.4 µg/m³ to 9.0 µg/m³ and Evansville - U of E from 9.1 µg/m³ to 8.9 µg/m³ for the 2021-2023 period. This concurrence would result in the Evansville CBSA attaining the 2024 annual PM_{2.5} standard. Table 2 summarizes the effect of this exceptional events demonstration on the monitor's design value.

⁵ See AQS Report AMP 355, Report Request ID: 2274683 dated March 25, 2025.

⁶ The EPA's Tiering Tool categorized these days as Tier 2, but the EPA evaluated them as Tier 1 as they are part of a multi-day Tier 1 event.

Table 2: Summary of Regulatory Significance

Monitoring Site	Affected Regulatory Action	21-23 Design Value without the EPA's Concurrence ($\mu\text{g}/\text{m}^3$)	21-23 Design Value with the EPA's Concurrence ($\mu\text{g}/\text{m}^3$)	22-24 Design Value without the EPA's Concurrence ($\mu\text{g}/\text{m}^3$)	22-24 Design Value with the EPA's Concurrence ($\mu\text{g}/\text{m}^3$)
Evansville - Buena Vista	Initial area designations determinations for the 2024 annual PM _{2.5} NAAQS	9.4	9.0	8.9	8.6
Evansville - U of E	Initial area designations determinations for the 2024 annual PM _{2.5} NAAQS	9.1	8.9	8.3	8.2

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 3 outlines the EPA's evaluation of these requirements.

Table 3: Procedural Criteria

Evidence	Demonstration Citation, if applicable	Summary of the EPA's Review	Criterion Met?
Did the agency appropriately flag the affected data in the EPA's Air Quality System?	Demonstration pp. 16-17; Indiana-PM _{2.5} Exceptional Events Initial Notification-Evansville	The EPA verified that IDEM applied request exclusion qualifiers to all PM _{2.5} monitors at the Evansville – Buena Vista monitoring site on June 14-16, 2022, July 22, 2022, June 4, 2023, June 6-10, 2023, June 16-18, 2023, June 27-29, 2023, July 4, 2023, and September 7, 2023, and the Evansville – U of E monitoring site on June 16, 2022, July 22, 2022, June 8, 2023, and July 4, 2023.	Y
Did the agency submit an Initial Notification?	Indiana-PM _{2.5} Exceptional Events Initial Notification-Evansville	IDEM submitted the Initial Notification via email to the EPA on November 8, 2024.	Y

Evidence	Demonstration Citation, if applicable	Summary of the EPA's Review	Criterion Met?
Did the initial notification and demonstration submittals meet the deadlines for data influenced by exceptional events for use in initial area designations?	Demonstration pp. 1-2, Indiana-PM _{2.5} Exceptional Events Initial Notification- Evansville	IDEM submitted the Initial Notification to the EPA on November 8, 2024, and the final demonstration to the EPA on January 22, 2025.	Y
Was the 30-day public comment process followed and documented?	Demonstration p. 320, Attachment A	IDEM solicited, reviewed, and documented public comments per 40 CFR § 50.14(c)(3)(v). The comment period was open from November 27, 2024, to December 27, 2024.	Y
Did the agency submit to the EPA, and address in their demonstration, any public comments received?	Demonstration p. 320; Attachment A	No public commentary was received.	Y

Mitigation Requirements

IDEM is not subject to mitigation planning requirements under 40 CFR § 51.930(b) for these events and the 2024 annual PM_{2.5} NAAQS.

Narrative Conceptual Model

IDEM's demonstration provided a narrative conceptual model for each event to describe how emissions from wildfires and fireworks caused PM_{2.5} exceedances at the Evansville - Buena Vista and Evansville - U of E monitoring stations.

The conceptual model for these events is supported by media reports, daily average PM_{2.5} concentration plots overlaid with the National Oceanic and Atmospheric Administration's Hazard Mapping System smoke plumes and active fire locations in AirNow-Tech, surface and upper air meteorological maps, and Canadian Wildland Information System active fire maps. These analyses support the conclusion that wildfire smoke was the primary contributor to the PM_{2.5} exceedances recorded at the Evansville - Buena Vista monitoring site on June 14-16, 2022, July 22, 2022, June 4, 2023, June 6-10, 2023, June 16-18, 2023, June 27-29, 2023, and September 7, 2023, and the Evansville - U of E monitoring site on June 16, 2022, July 22, 2022, and June 8, 2023. IDEM's analyses also support the conclusion that fireworks emissions were the primary contributor to the PM_{2.5} exceedances recorded at the Evansville – Buena Vista and Evansville - U of E monitoring sites on July 4, 2023.

The discussion of the interaction of wildfire smoke formation, fireworks, and meteorology resulting in impacts at the monitors in the Evansville area is consistent with the EPA's recommendations (Guidance on the Preparation of Exceptional Events Demonstrations for Wildfire Events that May Influence Ozone Concentrations (EPA, 2016), PM_{2.5} Wildland Fire Exceptional Events Tiering Document (EPA, 2024) and

40 CFR § 50.14(b)(2)). The regulatory significance of the proposed data exclusion is also discussed (see demonstration, pp. 1-2, 7-18, 321-324), as required by 40 CFR § 50.14(c)(3)(i).

June 14-16, 2022, Narrative Conceptual Model Overview

In June of 2022, there were active wildfires scattered throughout the Midwest, southern U.S., and southwestern U.S. and by June 14th, 2022, there was a concentration of smoke in Evansville, IN from the New Mexico, Arkansas, Missouri and the Mississippi River Valley. IDEM’s demonstration describes how a low-pressure system in the four corner states lifted into the Central Plains and a large upper-level ridge was developing over the southeastern U.S. On June 14th, 2022, a strong low-pressure system over Nebraska and a large surface high pressure over the southeastern U.S. drove strong, dry winds up the plains and northward into the Ohio Valley, funneling wildfire smoke from New Mexico, Arkansas, Missouri, western Mississippi, and the panhandle of Florida to southwest Indiana. These meteorological features created a southwesterly flow pattern that transported wildfire smoke from the southern region to the eastern U.S. including the Evansville, IN area through the entire period. The June 14-16, 2022, Hybrid Single-Particle Lagrangian Integrated Trajectory analyses intersected the source regions of the wildfires which supports the meteorological transport narrative in the demonstration.

Table 4: Narrative Conceptual Model for June 14-16, 2022

Evidence	Demonstration Citation	Summary of the EPA’s Review	Criterion Met?
Description of event(s) causing exceedance or violation	Demonstration pp. 25-27	IDEM described several fires in the U.S. which caused PM _{2.5} exceedances on June 14-16, 2022.	Y
Discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s)	Demonstration pp. 20-25	IDEM included meteorological surface and upper air (500 and 850 millibar heights) analyses as well as visible satellite imagery depicting wildfire smoke, which aligned with PM _{2.5} concentrations at ground level.	Y
Discusses the interaction of emissions and meteorology	Demonstration pp. 21-27	IDEM included daily average PM _{2.5} concentration plots overlaid with the NOAA’s HMS smoke plumes and active fire locations in AirNow-Tech, surface and upper air meteorological maps, Canadian Wildland Information System and Fire Information for Resource Management System active fire maps, and a meteorological narrative describing how the wildfire emissions from northern New Mexico and Arizona and southern and southeastern states were transported to the Evansville area.	Y

Evidence	Demonstration Citation	Summary of the EPA's Review	Criterion Met?
Explains regulatory significance	Demonstration pp. 1, 7-18, 321-324	IDEM explained these days are regulatory significant for initial area designations for the 2024 annual PM _{2.5} NAAQS.	Y

July 22, 2022, Narrative Conceptual Model Overview

Prior to and during the day of the event, there were active fires such as the Moose and Pine Peaks fires in Idaho producing heavy smoke in the northwest U.S. as well as in the southwest and central provinces in Canada. IDEM's demonstration describes a cold front that moved through the area on July 21, 2022, while a high-pressure ridge set-up in the southwest U.S which resulted in northwest winds. Another cold front started moving through Indiana on July 22, 2022, but weakened while the high-pressure ridge over the southwest U.S. drifted further east towards the Mississippi River valley. The synoptic meteorological pattern was conducive to transporting wildfire smoke from the northwest U.S. and southwest Canada to the upper Midwest, including Evansville on July 22, 2022. The HYSPLIT trajectories intersected the source regions of the northwest U.S. and Canadian wildfires and smoke which supports the meteorological transport narrative in the demonstration.

Table 5: Narrative Conceptual Model for July 22, 2022

Evidence	Demonstration Citation	Summary of the EPA's Review	Criterion Met?
Description of event(s) causing exceedance or violation	Demonstration pp. 55-61	IDEM described wildfire complexes in the northwest U.S. (Idaho) and southwestern Canada which caused PM _{2.5} exceedances on July 22, 2022.	Y
Discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s)	Demonstration pp. 56-59, 63-64	IDEM included meteorological surface and upper air (500 and 850 mb heights) analyses as well as visible satellite imagery depicting wildfire smoke, which aligned with PM _{2.5} concentrations at ground level.	Y

Evidence	Demonstration Citation	Summary of the EPA's Review	Criterion Met?
Discusses the interaction of emissions and meteorology	Demonstration pp. 56-61	IDEM included daily average PM _{2.5} concentration plots overlaid with the NOAA's HMS smoke plumes and active fire locations in AirNow-Tech, surface and upper air meteorological maps, Canadian Wildland Information System and Fire Information for Resource Management System active fire maps, and a meteorological narrative describing how the wildfire emissions from Idaho and Canada were transported to the Evansville area.	Y
Explains regulatory significance	Demonstration pp. 1, 7-18, 321-324	IDEM explained these days are regulatory significant for initial area designations for the 2024 annual PM _{2.5} NAAQS.	Y

June 4, 2023, and June 6-10, 2023, Narrative Conceptual Model Overview

Throughout the event, moderate to heavy fire danger conditions were reported across regions of Canada, with significant, out of control wildfire activity recorded in Quebec and southeastern Canada. IDEM's demonstration describes an upper-level high pressure system over the northern plains and western Great Lakes throughout the June 4 – 10, 2023, period as well as surface low pressure over the state of Maine. These two features contributed to the northerly wind flow that was maintained throughout the June 4 – 10 period. In addition, there were cold front passages on June 4 and June 6 in the Evansville area. After the second cold front passed through on June 6 to the south, surface high pressure settled northwest of the Evansville area which allowed the continual transport of Canadian wildfire smoke from Quebec and southeastern Canada to a wide swath of the Midwest, including Evansville, IN. The HYSPLIT analyses intersected the source regions of the Canadian wildfires, which supports the meteorological transport narrative in the demonstration.

Table 6: Narrative Conceptual Model for June 4, 2023, and June 6-10, 2023

Evidence	Demonstration Citation	Summary of the EPA's Review	Criterion Met?
Description of event(s) causing exceedance or violation	Demonstration pp. 137-146	IDEM described wildfire complexes in Quebec and Ontario which caused PM _{2.5} exceedances on June 4, 2023, and June 6-10, 2023.	Y
Discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s)	Demonstration pp. 129-146	IDEM included meteorological surface and upper air (500 and 850 mb heights) analyses as well as visible satellite imagery depicting wildfire smoke, which aligned with PM _{2.5} concentrations at ground level.	Y
Discusses the interaction of emissions and meteorology	Demonstration pp. 129-137	IDEM included daily average PM _{2.5} concentration plots overlaid with the NOAA's HMS smoke plumes and active fire locations in AirNow-Tech, surface and upper air meteorological maps, Canadian Wildland Information System and Fire Information for Resource Management System active fire maps, and a meteorological narrative describing how the wildfire emissions from Canada were transported to the Evansville area.	Y
Explains regulatory significance	Demonstration pp. 1, 7-18, 321-324	IDEM explained these days are regulatory significant for initial area designations for the 2024 annual PM _{2.5} NAAQS.	Y

June 16-18, 2023, Narrative Conceptual Model Overview

Throughout the event, moderate to heavy fire danger conditions were reported across regions of Canada, with significant, out of control wildfire activity recorded in Quebec and Ontario. IDEM's demonstration describes a cold front on June 15, 2023, that moved south across the area from the northwest while Canadian high pressure was building over the state. Behind the cold front, wildfire smoke was transported into the area under the influence of surface high pressure and an upper air ridge to the west. The flow from these meteorological features allowed transport of Canadian wildfire smoke from Quebec to a wide swath of the Midwest, including Evansville, IN. The building high-pressure system allowed the smoke to build up in the area causing elevated PM_{2.5} concentrations in Evansville. The June 16-18, 2023, HYSPLIT analysis intersected the source regions of the Canadian wildfire smoke, which supports the meteorological transport narrative in the demonstration.

Table 7: Narrative Conceptual Model for June 16-18, 2023

Evidence	Demonstration Citation	Summary of the EPA's Review	Criterion Met?
Description of event(s) causing exceedance or violation	Demonstration pp. 179-186	IDEM described wildfire complexes in Quebec and Ontario which caused PM _{2.5} exceedances on June 16-18, 2023.	Y
Discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s)	Demonstration pp. 180-183, 188 - 192	IDEM included meteorological surface and upper air (500 and 850 mb heights) analyses as well as visible satellite imagery depicting wildfire smoke, which aligned with PM _{2.5} concentrations at ground level. HYSPLIT trajectory analyses were also provided with back trajectories that showed wildfire smoke transport from areas of wildfire activity in Canada.	Y
Discusses the interaction of emissions and meteorology	Demonstration pp. 180-186	IDEM included daily average PM _{2.5} concentration plots overlaid with the NOAA's HMS smoke plumes and active fire locations in AirNow-Tech, surface and upper air meteorological maps, Canadian Wildland Information System and Fire Information for Resource Management System active fire maps, and a meteorological narrative describing how the wildfire emissions from Canada were transported to the Evansville area.	Y
Explains regulatory significance	Demonstration pp. 1, 7-18, 321-324	IDEM explained these days are regulatory significant for initial area designations for the 2024 annual PM _{2.5} NAAQS.	Y

June 27-29, 2023, Narrative Conceptual Model Overview

Throughout the event, extreme fire danger conditions were reported across regions of Canada, with significant, out of control wildfire activity recorded in Quebec. IDEM's demonstration describes a low-pressure system over the eastern portion of the U.S. with a high-pressure system settling in over the Hudson Bay. The flow around these two meteorological features allowed transport of Canadian wildfire smoke from Quebec to a wide swath of the eastern U.S., including Evansville, IN. The building high-pressure system allowed the smoke to accumulate in the area causing elevated PM_{2.5} concentrations in Evansville. These meteorological features allowed transport and stagnation of Canadian wildfire smoke

into eastern portions of the U.S., including Evansville, IN. The June 27-29, 2023, HYSPLIT analyses intersected the source regions of the Canadian wildfires which supports the meteorological transport narrative in the demonstration.

Table 8: Narrative Conceptual Model for June 27-29, 2023

Evidence	Demonstration Citation	Summary of the EPA's Review	Criterion Met?
Description of event(s) causing exceedance or violation	Demonstration pp. 210-216	IDEM described wildfire complexes in Quebec and Ontario which caused PM _{2.5} exceedances on June 27-29, 2023.	Y
Discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s)	Demonstration pp. 210-216	IDEM included meteorological surface and upper air (500 and 850 mb heights) analyses as well as visible satellite imagery depicting wildfire smoke, which aligned with PM _{2.5} concentrations at ground level.	Y
Discusses the interaction of emissions and meteorology	Demonstration pp. 210-216	IDEM included daily average PM _{2.5} concentration plots overlaid with the NOAA's HMS smoke plumes and active fire locations in AirNow-Tech, surface and upper-level meteorological maps, Canadian Wildland Information System active fire maps, and a meteorological narrative describing how the wildfire emissions from Canada were transported to the Evansville area.	Y
Explains regulatory significance	Demonstration pp. 1-2, 7-18, 321-324	IDEM explained these days are regulatory significant for initial area designations for the 2024 annual PM _{2.5} NAAQS.	Y

July 4, 2023, Narrative Conceptual Model Overview

IDEM's demonstration describes fireworks impacts on July 4, 2023, due to the Fourth of July holiday causing elevated PM_{2.5} concentrations during the evening hours at the Evansville - Buena Vista and Evansville - U of E monitors. Fireworks were set off in nearby neighborhoods and in downtown Evansville (<https://local-e.eisforeveryone.com/stories/fireworks>) on this day with spikes evident starting at 8:00 pm on July 4, 2023, and lasting through the overnight hours. The hourly data peaked at 107.9 µg/m³ at 10:00 pm for the Evansville - Buena Vista monitor. As the fireworks associated emissions lingered in the area due to stagnant conditions associated with a surface high pressure, the PM_{2.5} levels remained elevated at the Buena Vista monitor until the early morning hours of July 5, 2023. These meteorological conditions hindered the dispersion of the fireworks emissions until winds picked up slightly the next day when daytime heating and mixing began.

Table 9: Narrative Conceptual Model for July 4, 2023

Evidence	Demonstration Citation	Summary of the EPA's Review	Criterion Met?
Description of event(s) causing exceedance or violation	Demonstration pp. 245, 259	IDEM described neighborhood fireworks which caused PM _{2.5} exceedances on July 4, 2023.	Y
Discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s)	Demonstration pp. 245-247, 254-255, 257	IDEM included meteorological surface and upper air (500 and 850 mb heights) analyses as well as hourly PM _{2.5} and carbon concentrations.	Y
Discusses the interaction of emissions and meteorology	Demonstration pp. 245-247, 259	IDEM included daily average PM _{2.5} concentration plots, surface and upper air (500 and 850 mb heights) meteorological maps, and a meteorological narrative describing how the firework emissions affected the Evansville monitors.	Y
Explains regulatory significance	Demonstration pp. 1, 7-18, 321-324	IDEM explained these days are regulatory significant for initial area designations for the 2024 annual PM _{2.5} NAAQS.	Y

September 7, 2023, Narrative Conceptual Model Overview

Leading up to and throughout the event, large wildfires continued to burn in British Columbia, Alberta, and the Northwest Territories in Canada. IDEM's demonstration describes a cold front associated with a low-pressure system push east through the midwest bringing Canadian wildfire smoke from British Columbia and Alberta to the Evansville area behind the front. The September 7, 2023, HYSPLIT analysis shows transport from the northwest which aligns with the plume from western Canadian wildfires which supports the meteorological transport narrative in the demonstration.

Table 10: Narrative Conceptual Model for September 7, 2023

Evidence	Demonstration Citation	Summary of the EPA's Review	Criterion Met?
Description of event(s) causing exceedance or violation	Demonstration pp. 297-304	IDEM described wildfire complexes in Alberta and British Columbia which caused the PM _{2.5} exceedance on September 7, 2023.	Y
Discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s)	Demonstration pp. 297-304	IDEM included meteorological surface and upper air (500 and 850 mb heights) analyses as well as HMS smoke plumes, which aligned with PM _{2.5} concentrations at ground level.	Y

Evidence	Demonstration Citation	Summary of the EPA's Review	Criterion Met?
Discusses the interaction of emissions and meteorology	Demonstration pp. 297-304	IDEM included meteorological surface analyses, a HYSPLIT trajectory analysis, and a meteorological narrative describing how the wildfire emissions from Canada were transported to the Evansville area.	Y
Explains regulatory significance	Demonstration pp. 1-2, 7-18, 321-324	IDEM explained these days are regulatory significant for initial area designations for the 2024 annual PM _{2.5} NAAQS.	Y

Clear Causal Relationship and Supporting Analyses

IDEM's demonstration included the EPA's Tiering Tool analysis, comparison of event days with historical concentrations, HYSPLIT trajectory analyses (forward and backward), Aerosol Optical Depth and visible satellite imagery, NOAA's HMS smoke plumes and active fire locations in AirNowTech, General Additive Model, High-Resolution Rapid Refresh-Smoke model, BlueSky smoke model, carbon and PM_{2.5} timeseries, media articles, IDEM air quality forecasts, and NOAA's Satellite Smoke Narrative to demonstrate the clear causal relationship between wildfire smoke or fireworks emissions and the monitors in the Evansville area. Based on the measured PM_{2.5} values, as well as other criteria, the days described in this TSD, for which the EPA is concurring on, are Tier I events.

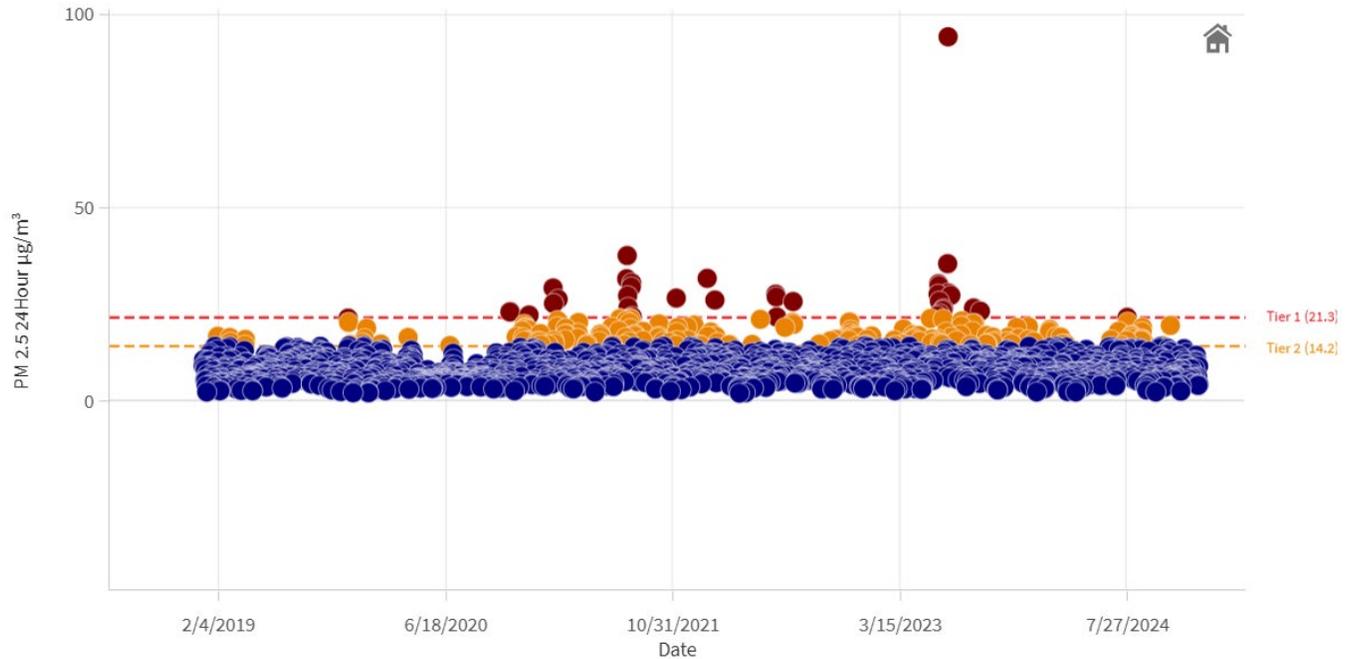
Comparison with Historical Concentrations

The demonstration includes a comparison with historical concentrations, as required by 40 CFR § 50.14(c)(3)(iv)(C). The demonstration compares daily average PM_{2.5} concentrations during the wildfire smoke and fireworks emissions events on June 14-16, 2022, July 22, 2022, June 4, 2023, June 6-10, 2023, June 16-18, 2023, June 27-29, 2023, July 4, 2023, and September 7, 2023, to the 5-year average which illustrate the enhancement of PM_{2.5} concentrations on the event days compared to monitor concentrations during the rest of the year. As shown in Figures 1 to 3 below, event concentrations for the two monitors are compared to the Tier 1 cutoff for justification of the demonstration's tier selection.

Figure 1: The EPA's PM_{2.5} Tiering Tool for Exceptional Events Analysis (Evansville – Buena Vista – June)

AQS Site ID 181630021

R and I Fire Flags Excluded From Tiering Calculation

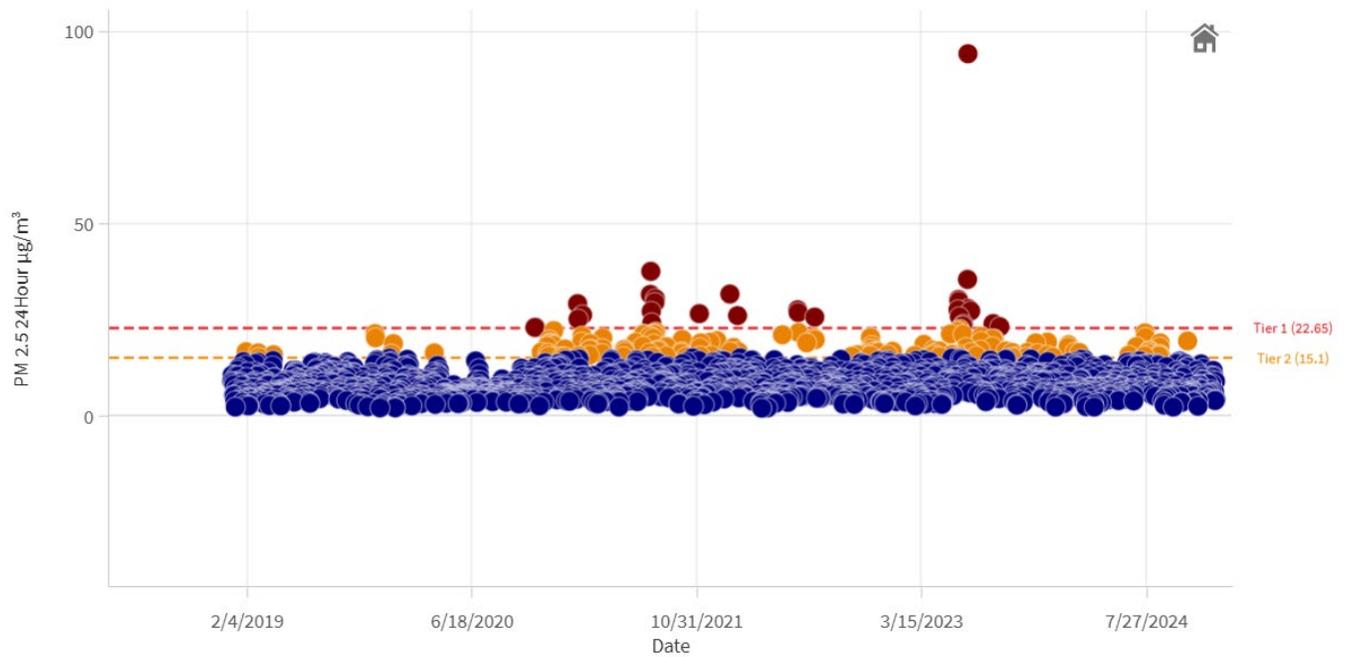


AQS data last updated 4/24/2025

Figure 2: The EPA's PM_{2.5} Tiering Tool for Exceptional Events Analysis (Evansville - Buena Vista – July/September)

AQS Site ID 181630021

R and I Fire Flags Excluded From Tiering Calculation

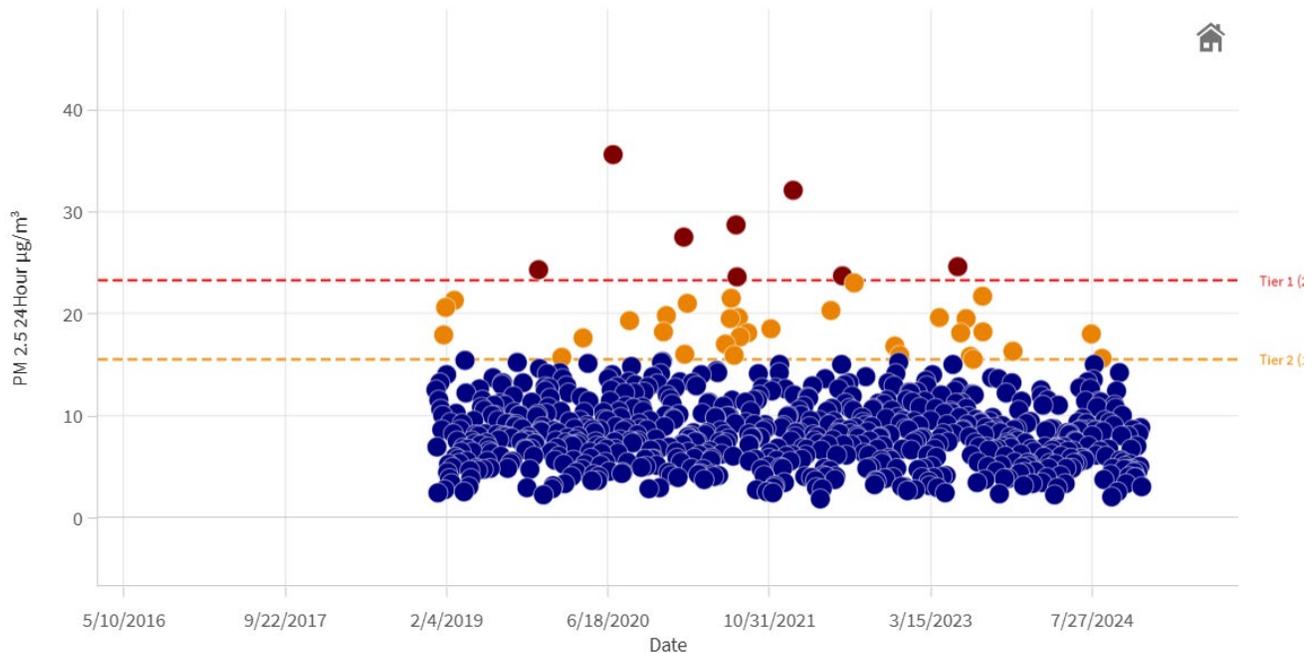


AQS data last updated 4/24/2025

Figure 3: The EPA’s PM_{2.5} Tiering Tool for Exceptional Events Analysis (Evansville – U of E – June/July)

AQS Site ID 181630016

R and I Fire Flags Excluded From Tiering Calculation



AQS data last updated 4/24/2025

Table 11: Summary of Tiering for Relevant Monitoring Days

Tiering	Demonstration Citation	Tiering Details	Tiers
Tiering for Evansville - Buena Vista monitoring site on June 14-16, 2022, July 22, 2022, June 4, 2023, June 6-10, 2023, June 16-18, 2023, June 27-29, 2023, July 4, 2023, and September 7, 2023, and Evansville - U of E monitoring site on June 16, 2022, July 22, 2022, June 8, 2023, and July 4, 2023.	Demonstration pp. 1-18	IDEM cited the EPA’s Tiering Tool. Flags excluded from the calculation included R and I Fire Flags. The tiering thresholds were determined by analyzing the full 5-year dataset from 2019-2023.	1

June 14-16, 2022

Evidence of Transport of Wildfire Emissions from the Wildfire to the Monitors

For the exceedances on June 14-16, 2022, IDEM’s demonstration presents evidence of smoke transport from multiple fires in the U.S. (northern New Mexico and Arizona, southern and southeastern states including the Mississippi River valley area) to the Evansville area (see demonstration, pp. 29-38, Figs. 2.1.11-2.1.19). Analyses are supported by forward and backward HYSPLIT trajectories overlaid on PM_{2.5}

concentrations, smoke contours, and fire data (see demonstration, pp. 29-32, Figs. 2.1.11-2.1.13), AOD and visible satellite imagery (see demonstration, pp. 32-34, Figs. 2.1.14-2.1.16), HRRR-Smoke vertically integrated model outputs (see demonstration, pp. 34-35, Fig. 2.1.17), BlueSky Smoke Forecast model outputs (see demonstration, pp. 36-37, Fig. 2.1.18), and GAM analyses (see demonstration, pp. 37-38, Fig. 2.1.19). HYSPLIT trajectories provided by IDEM illustrate transport of smoke from across the southwest and southcentral U.S. to the Evansville area on June 14-16, 2022. Smoke is also evident on the satellite imagery.

Evidence that the Wildfire Emissions Affected the Monitors

The PM_{2.5} concentration maps, GAM analyses, and carbon concentration timeseries show the transport of smoke from the southwest and southcentral U.S. wildfires to Evansville and depict the smoke impacts at the monitor level from June 14-16, 2022 (see demonstration, pp. 28-29 and 37-42, Figs. 2.1.8-2.1.10 and 2.1.19-2.1.22). Additionally, IDEM included media articles and NOAA Satellite Smoke text products that discussed the wildfire plumes in the southwest and southcentral U.S. (see demonstration, pp. 46-53).

Table 12: Clear Causal Relationship for June 14-16, 2022

Evidence	Demonstration Citation, if applicable	Summary of the EPA’s Review	Criterion Met?
Comparison of Event-Related and Historical Concentrations⁷			
Tiering Tool plots across 5-years (2019-2023) and daily average PM _{2.5} concentration plots	Demonstration pp. 1-18 and 21	PM _{2.5} concentrations for the June 14-16, 2022, event exceeded 1.5 times the Tiering Threshold, confirming Tier 1 and distinct elevated concentrations.	Y

⁷The EPA’s Guidance Prescribed Fire on Wildland that May Influence Ozone and Particulate Matter Concentrations (Prescribed Fire Guidance) offers examples of analyses that may be used to satisfy the comparison to historical concentrations criterion for wildland fires that may have influenced PM concentrations, including: Comparison of concentration on the claimed event day(s) with a set of similar days, a percentile of event-related concentration(s) relative to annual and/or seasonal data; 99th percentile over 5 years or fourth highest within one year; Description of past high data points labeled as being associated with previous exceptional events, suspected exceptional events, other unusual occurrences, or high pollution days due to normal emissions, with basic evidence to support claims and recognition that a history of concentrations above the standard could indicate additional evidence needed; Indication of how typically observed non-event diurnal or seasonal pattern differs, if such a deviation occurred, due to the event, with more weight given to effective statistical summaries that characterize non-event, high-concentration day historical data and the differences seen on event days over anecdotal or general assertions.

Evidence	Demonstration Citation, if applicable	Summary of the EPA's Review	Criterion Met?
Evidence that the Fire Emissions were Transported to the Monitor(s)⁸			
HYSPLIT Trajectories, Satellite Imagery (AOD, visible, HMS smoke plumes, and detections of active fires in the U.S.), the HRRR-Smoke model, and the BlueSky model	Demonstration pp. 30-37	HYSPLIT trajectories (backward and forward), satellite imagery, HRRR-Smoke model outputs, and BlueSky model outputs demonstrated smoke transport from across the U.S. to Evansville on June 14-16, 2022.	Y
Evidence that the Fire Emissions Affected the Monitor(s)⁹			
PM _{2.5} surface concentrations, GAM analyses, carbon concentration timeseries, media articles, and NOAA smoke narratives	Demonstration pp. 28-29, 37-42, and 46-53	Spatial distribution of PM _{2.5} across the Midwest demonstrates regional impacts of wildfire smoke at the ground level on June 14-16, 2022. Additionally, IDEM's GAM analyses, carbon concentration timeseries, media articles, and NOAA smoke narratives show the wildfire smoke plume impacts at the surface.	Y
Concluding Statement			
Inclusion of a concluding statement that explains how the demonstration meets the relevant statutory and regulatory criteria	Demonstration pp. 53-54 and 321	IDEM's demonstration summarizes how the demonstration meets the requirements in the Exceptional Event Rule and meets the clear causal criteria.	Y

July 22, 2022

Evidence of Transport of Wildfire Emissions from the Wildfire to the Monitors

For the exceedances on July 22, 2022, IDEM's demonstration presents evidence of smoke transport from Idaho and southwest Canadian wildfires to the Evansville area (see demonstration, pp. 62-67, Figs. 2.2.8-2.2.12). Analyses are supported by forward and backward HYSPLIT trajectories overlaid on PM_{2.5}

⁸The EPA's Prescribed Fire Guidance offers examples of analyses that may be used to show emissions transport from wildland fires that may have influenced PM concentrations, including: Atmospheric trajectory analysis/modeling; Satellite imagery of plume with evidence of plume impacting the ground; Satellite imagery of plume with evidence of plume impacting the ground; Provision of additional information, such as analyses of relevant meteorological conditions (e.g., wind speed and direction at the height of the smoke plume) further supporting the clear causal relationship rule element.

⁹ The EPA's Prescribed Fire Guidance offers examples of analyses that may be used to show impacts from emissions of wildland fires at the monitor, including: Plots of elevated fire-related species near the monitor (e.g., PM, carbon monoxide); Elevated light extinction measurements at or near the monitoring site; Photographic evidence of ground-level smoke at the monitor; The timing and spatial distribution of fire-related pollutants shown with data from multiple monitoring sites; Differences in carbon monoxide: nitrogen oxides ratios, and/or; PM speciation data that indicate fire impacts; Inclusion of matching day analyses, statistical regression models, or photochemical models, as needed.

concentrations, smoke contours, and fire data (see demonstration, p. 63, Fig. 2.2.8), AOD and visible satellite imagery (see demonstration, p. 64, Fig. 2.2.9), HRRR-Smoke vertically integrated model analyses (see demonstration, pp. 64-65, Fig. 2.2.10), and GAM analyses (see demonstration, pp. 66-67, Fig. 2.2.12). HYSPLIT trajectories provided by IDEM illustrate transport of smoke from the northwest U.S. and southwest and central Canada to the Evansville area on July 22, 2022. Smoke is also evident on the satellite imagery. The EPA further analyzed forward and backward trajectories for July 22, 2022, and demonstrated transport of wildfire from fire complexes in eastern Idaho as well as central Canada (see Figs. 4 and 5 below).

Figure 4: Backward trajectories at 100-, 500-, and 1,000-meter heights starting on July 22, 2022, at 12:00 PM CDT from Evansville and forward trajectories at 100-, 500-, and 1,000-meter heights starting on July 19, 2022, at 12:00 PM CDT. Trajectories were developed in AirNow-Tech's Navigator tool and the map was overlaid with hourly PM_{2.5} concentrations and HMS Fire satellite detected hotspots.

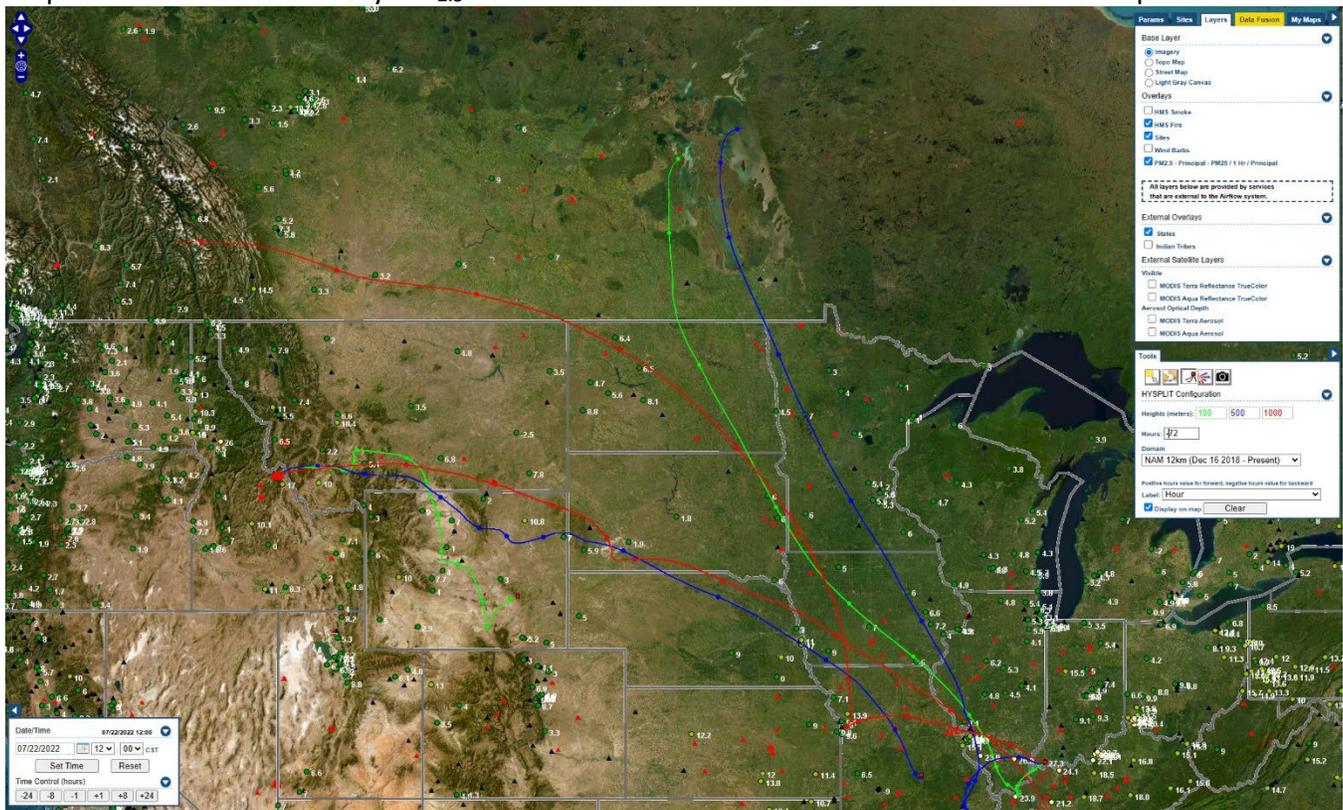
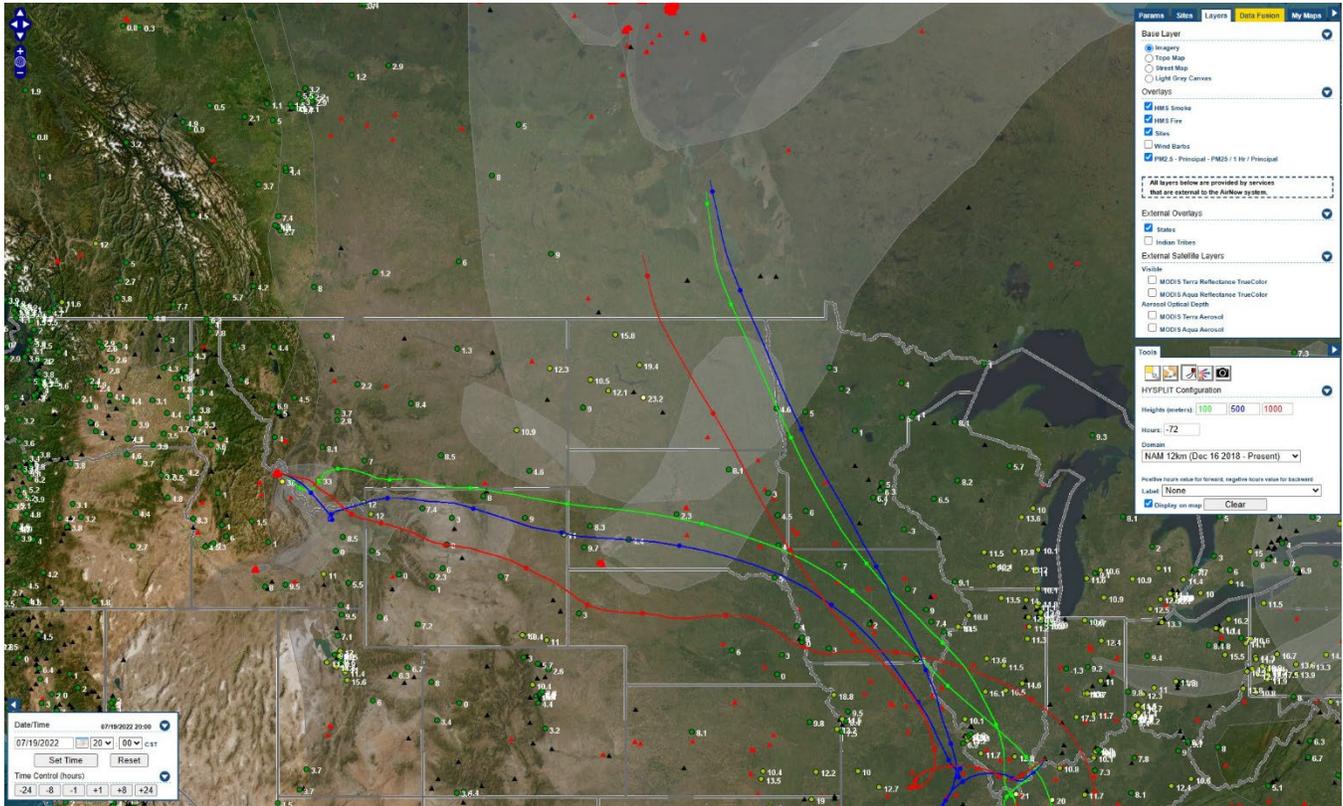


Figure 5: Backward trajectories at 100-, 500-, and 1,000-meter heights starting on July 22, 2022, at 8:00 PM CDT from Evansville and forward trajectories at 100-, 500-, and 1,000-meter heights starting on July 19, 2022, at 8:00 PM CDT. Trajectories were developed in AirNow-Tech's Navigator tool and the map was overlaid with hourly PM_{2.5} concentrations, HMS Fire satellite detected hotspots, and HMS Smoke detected plumes. HMS hotspots and plumes displayed in this figure represent conditions at 8:00 PM on July 19, 2022.



Evidence that the Wildfire Emissions Affected the Monitors

The PM_{2.5} concentration maps, GAM analyses, and carbon concentration timeseries show the transport of smoke from Idaho and Canadian wildfires to Evansville and depict the smoke impacts at the monitor level on July 22, 2022 (see demonstration, pp. 61-62 and 66-70, Figs. 2.2.7, 2.2.12-2.2.13, and 2.2.15). Additionally, IDEM included media articles, NOAA Satellite Smoke text products, and IDEM air quality forecasts discussing the wildfire plumes in the northwest and central U.S. as well as Evansville (see demonstration, pp. 72-93).

Table 13: Clear Causal Relationship for July 22, 2022

Evidence	Demonstration Citation, if applicable	Summary of the EPA's Review	Criterion Met?
Comparison of Event-Related and Historical Concentrations			
Tiering Tool plots across 5-years (2019-2023) and daily average PM _{2.5} concentration plots	Demonstration pp. 1-18 and 56	PM _{2.5} concentrations for the July 22, 2022, event exceeded 1.5 times the Tiering Threshold, confirming Tier 1 and distinct elevated concentrations.	Y
Evidence that the Fire Emissions were Transported to the Monitor(s)			
HYSPLIT Trajectories, Satellite Imagery (AOD, visible, HMS smoke plumes, and detections of active fires in Canada), and the HRRR-Smoke model	Demonstration pp. 63-6	HYSPLIT trajectories (backward and forward), satellite imagery, and HRRR-Smoke model outputs demonstrated smoke transport from eastern Idaho and central Canada to Evansville on July 22, 2022.	Y
Evidence that the Fire Emissions Affected the Monitor(s)			
PM _{2.5} surface concentrations, GAM analyses, carbon concentration timeseries, media articles, NOAA smoke narratives, and IDEM air quality forecasts	Demonstration pp. 62 and 66-93	Spatial distribution of PM _{2.5} across the Midwest demonstrates regional impacts of wildfire smoke at the ground level on July 22, 2022. Additionally, IDEM's GAM analyses, carbon concentration timeseries, media articles, NOAA smoke narratives, and IDEM air quality forecasts show the wildfire smoke plume impacts at the surface.	Y
Concluding Statement			
Inclusion of a concluding statement that explains how the demonstration meets the relevant statutory and regulatory criteria	Demonstration pp. 94-95, 321	IDEM's demonstration summarizes how the demonstration meets the requirements in the Exceptional Event Rule and meets the clear causal criteria.	Y

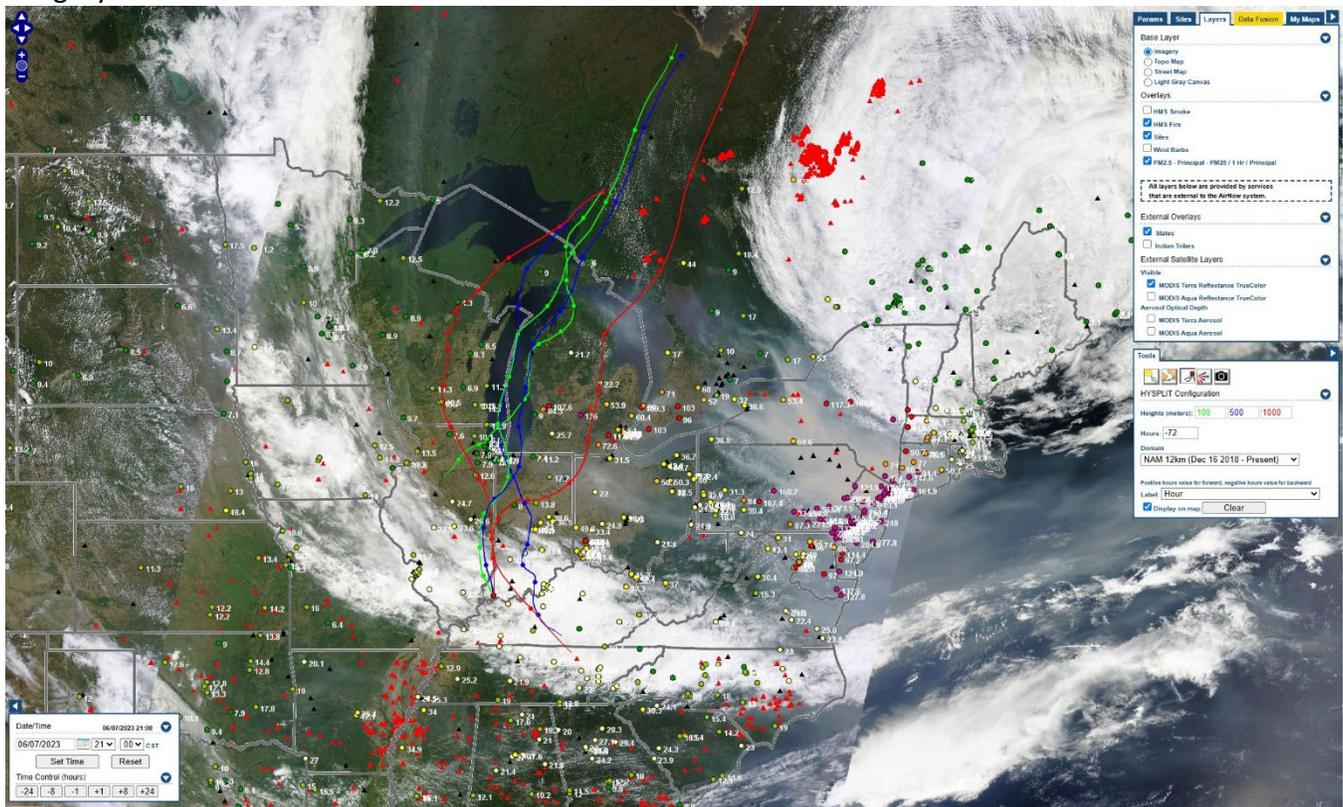
June 4, 2023, and June 6-10, 2023

Evidence of Transport of Wildfire Emissions from the Wildfire to the Monitors

For the exceedances on June 4, 2023, and June 6-10, 2023, IDEM's demonstration presents evidence of smoke transport from Quebec and southeastern Canadian wildfires to the Evansville area (see demonstration, pp. 149-162, Figs. 2.4.20-2.4.34). Analyses are supported by forward and backward HYSPLIT trajectories overlaid on PM_{2.5} concentrations, smoke contours, and fire data (see demonstration, pp. 150-154, Figs. 2.4.20-2.4.26), AOD and visible satellite imagery (see demonstration,

pp. 155-157, Figs. 2.4.27-2.4.32), HRRR-Smoke model analyses (see demonstration, pp. 158-160, Fig 2.4.33), and GAM analyses (see demonstration, pp. 160-162, Fig. 2.4.34). HYSPLIT trajectories illustrate transport of smoke from eastern Canada to the Evansville area on June 4, 2023, and June 6-10, 2023. Smoke is also evident on the satellite imagery. The forward trajectory provided by IDEM on June 6, 2023, had a start location in western NY in the downwind path of the Canadian wildfires and the 100 m height trajectory showed transport to Evansville. The backward and forward trajectories provided by IDEM for June 7, 2023, showed transport of wildfire smoke over the Great Lakes states to Evansville. The EPA further analyzed forward and backward trajectories for June 7, 2023, and demonstrated transport of smoke from Canada (see Fig. 6 below).

Figure 6: Backward trajectories at 100-, 500-, and 1,000-meter heights starting on June 7, 2023, at 9:00 PM CDT from Evansville and forward trajectories at 100-, 500-, and 1,000-meter heights starting on June 4, 2023, at 9:00 PM CDT. Trajectories were developed in AirNow-Tech’s Navigator tool and the map was overlaid with hourly PM_{2.5} concentrations, HMS Fire satellite detected hotspots, and visible satellite imagery.



Evidence that the Wildfire Emissions Affected the Monitors

The PM_{2.5} concentration maps, GAM analyses, and carbon concentration timeseries show the transport of the smoke from Canadian wildfires to Evansville and depict the smoke impacts at the monitor level leading up to and on June 4-10, 2023 (see demonstration, pp. 147-149, Figs. 2.4.14-2.4.19). Additionally, IDEM included media articles, NOAA Satellite Smoke text products, and IDEM air quality forecasts discussing the wildfire plume impacts in the eastern U.S. as well as Evansville (see demonstration, pp. 171-177).

Table 14: Clear Causal Relationship for June 4, 2023, and June 6-10, 2023

Evidence	Demonstration Citation, if applicable	Summary of the EPA’s Review	Criterion Met?
Comparison of Event-Related and Historical Concentrations			
Tiering Tool plots across 5-years (2019-2023) and daily average PM _{2.5} concentration plots	Demonstration pp. 1-18 and 129	PM _{2.5} concentrations for the June 4, 2023, and June 6-10, 2023, event exceeded 1.5 times the Tiering Threshold, confirming Tier 1 and distinct elevated concentrations.	Y
Evidence that the Fire Emissions were Transported to the Monitor(s)			
HYSPLIT Trajectories, Satellite Imagery (AOD, visible, HMS smoke plumes, and detections of active fires in Canada), and the HRRR-Smoke model	Demonstration pp. 150-160	HYSPLIT trajectories (backward and forward), satellite imagery, and HRRR-Smoke model outputs demonstrated smoke transport from Quebec to Evansville on June 4, 2023, and June 6-10, 2023.	Y
Evidence that the Fire Emissions Affected the Monitor(s)			
PM _{2.5} surface concentrations, GAM analyses, carbon concentration timeseries, media articles, NOAA smoke narratives, and IDEM air quality forecasts	Demonstration pp. 147-149 and 160-177	Spatial distribution of PM _{2.5} across the Midwest demonstrates regional impacts of wildfire smoke at the ground level on June 4, 2023, and June 6-10, 2023. Additionally, IDEM’s GAM analyses, carbon concentration timeseries, media articles, NOAA smoke narratives, and IDEM air quality forecasts show the wildfire smoke plume impacts at the surface.	Y
Concluding Statement			
Inclusion of a concluding statement that explains how the demonstration meets the relevant statutory and regulatory criteria	Demonstration pp. 178-179, 321	IDEM’s demonstration summarizes how the demonstration meets the requirements in the Exceptional Event Rule and meets the clear causal criteria.	Y

June 16-18, 2023

Evidence of Transport of Wildfire Emissions from the Wildfire to the Monitors

For the exceedances on June 16-18, 2023, IDEM’s demonstration presents evidence of smoke transport from Quebec and Ontario wildfires to the Evansville area (see demonstration, pp. 188-195, Figs. 2.5.12-2.5.19). Analyses are supported by forward and backward HYSPLIT trajectories overlaid on PM_{2.5} concentrations, smoke contours, and fire data (see demonstration, pp. 189-190, Figs. 2.5.12-2.5.14),

AOD and visible satellite imagery (see demonstration, pp. 191-192, Figs. 2.5.15-2.5.17), HRRR-Smoke analyses (see demonstration, pp. 192-193, Fig. 2.5.18), and GAM analyses (see demonstration, pp. 194-195, Fig. 2.5.19). HYSPLIT trajectories illustrate transport of smoke from eastern Canada to the Evansville area on June 16-18, 2023. Smoke is also evident on the satellite imagery.

Evidence that the Wildfire Emissions Affected the Monitors

The PM_{2.5} concentration maps, GAM analyses, and carbon concentration timeseries show the transport of the smoke from Canadian wildfires to Evansville and depict the smoke impacts at the monitor level leading up to and on June 16, 2023, to June 18, 2023 (see demonstration, pp. 187-188 and 194-198, Figs. 2.5.9-2.5.11, 2.5.19-2.5.20). Additionally, IDEM included media articles, NOAA Satellite Smoke Text Products, and IDEM air quality forecasts discussing the wildfire plume impacts in the eastern U.S. as well as Evansville (see demonstration, pp. 200-209).

Table 15: Clear Causal Relationship for June 16-18, 2023

Evidence	Demonstration Citation, if applicable	Summary of the EPA’s Review	Criterion Met?
Comparison of Event-Related and Historical Concentrations			
Tiering Tool plots across 5-years (2019-2023) and daily average PM _{2.5} concentration plots	Demonstration pp. 1-18, 180	PM _{2.5} concentrations for the June 16-18, 2023, event exceeded 1.5 times the Tiering Threshold, confirming Tier 1 and distinct elevated concentrations.	Y
Evidence that the Fire Emissions were Transported to the Monitor(s)			
HYSPLIT Trajectories, Satellite Imagery (AOD, visible, HMS smoke plumes, and detections of active fires in Canada), and the HRRR-Smoke model	Demonstration pp. 189-193	HYSPLIT trajectories (backward and forward), satellite imagery, and HRRR-Smoke model outputs demonstrated smoke transport from Quebec and Ontario to Evansville on June 16-18, 2023.	Y
Evidence that the Fire Emissions Affected the Monitor(s)			
PM _{2.5} surface concentrations, GAM analyses, carbon concentration timeseries, media articles, NOAA smoke narratives, and IDEM air quality forecasts	Demonstration pp. 187-188 and 194-209	Spatial distribution of PM _{2.5} across the Midwest demonstrates regional impacts of wildfire smoke at the ground level on June 16-18, 2023. Additionally, IDEM’s GAM analyses, carbon concentration timeseries, media articles, NOAA smoke narratives, and IDEM air quality forecasts show the wildfire smoke plume impacts at the surface.	Y

Evidence	Demonstration Citation, if applicable	Summary of the EPA's Review	Criterion Met?
Concluding Statement			
Inclusion of a concluding statement that explains how the demonstration meets the relevant statutory and regulatory criteria	Demonstration pp. 209-210, 321	IDEM's demonstration summarizes how the demonstration meets the requirements in the Exceptional Event Rule and meets the clear causal criteria.	Y

June 27-29, 2023

Evidence of Transport of Wildfire Emissions from the Wildfire to the Monitors

For the exceedances on June 27-29, 2023, IDEM's demonstration presents evidence of smoke transport from Quebec wildfires to the Evansville area (see demonstration, pp. 219-225, Figs. 2.6.11-2.6.18). Analyses are supported by forward and backward HYSPLIT trajectories overlaid on PM_{2.5} concentrations, smoke contours, and fire data (see demonstration, pp. 219-220, Figs. 2.6.11-2.6.13), AOD and visible satellite imagery (see demonstration, pp. 221-222, Figs. 2.6.14-2.6.16), HRRR-Smoke analyses (see demonstration, pp. 223-224, Fig. 2.6.17), and GAM analyses (see demonstration, pp. 224-225, Fig. 2.6.18). HYSPLIT trajectories illustrate transport of smoke from eastern Canada to the Evansville area on June 27-29, 2023. Smoke is also evident on the satellite imagery.

Evidence that the Wildfire Emissions Affected the Monitors

The PM_{2.5} concentration maps, GAM analyses, and carbon concentration timeseries show the transport of the smoke from Canadian wildfires to Evansville and depict the smoke impacts at the monitor level leading up to and on June 27-29, 2023 (see demonstration, pp. 217-230, Figs. 2.6.8-2.6.10, 2.6.18-2.6.19, 2.6.21). Additionally, IDEM included media articles, NOAA smoke narratives, and IDEM air quality forecasts discussing the wildfire plume impacts in the eastern U.S. as well as Evansville (see demonstration, pp. 231-243).

Table 16: Clear Causal Relationship for June 27-29, 2023

Evidence	Demonstration Citation, if applicable	Summary of the EPA's Review	Criterion Met?
Comparison of Event-Related and Historical Concentrations			
Tiering Tool plots across 5-years (2019-2023) and daily average PM _{2.5} concentration plots	Demonstration pp. 7-18, 211, 226	PM _{2.5} concentrations for the June 27-29, 2023, event exceeded 1.5 times the Tiering Threshold, confirming Tier 1 and distinct elevated concentrations.	Y

Evidence	Demonstration Citation, if applicable	Summary of the EPA's Review	Criterion Met?
Evidence that the Fire Emissions were Transported to the Monitor(s)			
HYSPLIT Trajectories, Satellite Imagery (AOD, visible, HMS smoke plumes, and detections of active fires in Canada), and the HRRR-Smoke model	Demonstration pp. 219-224	HYSPLIT trajectories (backward and forward), satellite imagery, and the HRRR-Smoke model demonstrated smoke transport from Quebec to Evansville on June 27-29, 2023.	Y
Evidence that the Fire Emissions Affected the Monitor(s)			
PM _{2.5} surface concentrations, GAM analyses, carbon concentration timeseries, media articles, NOAA smoke narratives, and IDEM air quality forecasts	Demonstration pp. 217-218, 224-243	Spatial distribution of PM _{2.5} across the Midwest demonstrates regional impacts of wildfire smoke at the ground level on June 27-29, 2023. Additionally, IDEM's GAM analyses, carbon concentration timeseries, media articles, NOAA smoke narratives, and IDEM air quality forecasts show the wildfire smoke plume impacts at the surface.	Y
Concluding Statement			
Inclusion of a concluding statement that explains how the demonstration meets the relevant statutory and regulatory criteria	Demonstration pp. 243-245, 321	IDEM's demonstration summarizes how the demonstration meets the requirements in the Exceptional Event Rule and meets the clear causal criteria.	Y

July 4, 2023

For the exceedances on July 4, 2023, IDEM's demonstration presents evidence of fireworks impacts on July 4, 2023, due to neighborhood and the city of Evansville fireworks emissions. The city of Evansville fireworks show took place on the same day as the recorded exceedance at both the Evansville - Buena Vista and Evansville - U of E monitors (<https://local-e.eisforeveryone.com/stories/fireworks>). The fireworks impacts are supported by hourly PM_{2.5} and carbon timeseries showing a clear spike in concentrations at 8:00 pm on July 4, 2023, and lasting throughout the overnight hours as meteorological conditions were stagnant (see demonstration, pp. 245-247, 254-255, 257, 259).

Table 17: Clear Causal Relationship for July 4, 2023

Evidence	Demonstration Citation, if applicable	Summary of the EPA's Review	Criterion Met?
Comparison of Event-Related and Historical Concentrations			
Tiering Tool plots across 5-years (2019-2023) and daily average PM _{2.5} concentration plots	Demonstration pp. 7-18, 246, 253	PM _{2.5} concentrations for the July 4, 2023, event exceeded 1.5 times the Tiering Threshold, confirming Tier 1 and distinct elevated concentrations.	Y
Evidence that the Fireworks Emissions were Transported and Affected the Monitor(s)			
PM _{2.5} and carbon concentration timeseries, and media articles	Demonstration pp. 245-247, 254-255, 257, 259	The city of Evansville fireworks show timing aligns with the spike of PM _{2.5} and carbon concentrations on July 4, 2023.	Y
Concluding Statement			
Inclusion of a concluding statement that explains how the demonstration meets the relevant statutory and regulatory criteria	Demonstration pp. 259-260, 321	IDEM's demonstration summarizes how the demonstration meets the requirements in the Exceptional Event Rule and meets the clear causal criteria.	Y

September 7, 2023

Evidence of Transport of Wildfire Emissions from the Wildfire to the Monitors

For the exceedance on September 7, 2023, IDEM's demonstration presents evidence of smoke transport from Alberta and British Columbia wildfires to the Evansville area (see demonstration, pp. 306-308, Figs. 2.9.8, 2.9.10). Analyses are supported by forward and backward HYSPLIT trajectories overlaid on PM_{2.5} concentrations, smoke contours, and fire data (see demonstration, p. 306, Fig. 2.9.8) and HRRR-Smoke analyses (see demonstration, p. 308, Fig. 2.9.10). HYSPLIT trajectories illustrate transport of smoke from western Canada to the Evansville area on September 7, 2023.

Evidence that the Wildfire Emissions Affected the Monitors

The PM_{2.5} concentration maps show the spatial impacts of the Canadian wildfire smoke plume at the monitor level on September 7, 2023 (see demonstration, p. 305, Fig. 2.9.7). These maps support the transport of the smoke and visually depict the smoke impacts on September 7, 2023. Additionally, IDEM included media articles, NOAA smoke narratives, and IDEM air quality forecasts discussing the wildfire plume impacts in the Midwest as well as Evansville (see demonstration, p. 312-318).

Table 18: Clear Causal Relationship for September 7, 2023

Evidence	Demonstration Citation, if applicable	Summary of the EPA’s Review	Criterion Met?
Comparison of Event-Related and Historical Concentrations			
Tiering Tool plots across 5-years (2019-2023) and daily average PM _{2.5} concentration plots	Demonstration pp. 7-18, 298, 309	PM _{2.5} concentrations on September 7, 2023, exceeded 1.5 times the Tiering Threshold, confirming Tier 1 and distinct elevated concentrations.	Y
Evidence that the Fire Emissions were Transported to the Monitor(s)			
HYSPLIT Trajectories and Satellite Imagery (HMS smoke plumes, and detections of active fires in Canada), and the HRRR-Smoke model	Demonstration pp. 306-308	HYSPLIT trajectories (backward and forward) and the HRRR-Smoke model demonstrated smoke transport from Alberta and British Columbia to Evansville on September 7, 2023.	Y
Evidence that the Fire Emissions Affected the Monitor(s)			
PM _{2.5} surface concentrations, carbon concentration timeseries, media articles, NOAA smoke narratives, and IDEM air quality forecasts	Demonstration pp. 305, 309-318	Spatial distribution of PM _{2.5} across the Midwest demonstrates regional impacts of wildfire smoke at the ground level on September 7, 2023. Additionally, IDEM’s carbon concentration timeseries, media articles, NOAA smoke narratives, and IDEM air quality forecasts show the wildfire smoke plume impacts at the surface.	Y
Concluding Statement			
Inclusion of a concluding statement that explains how the demonstration meets the relevant statutory and regulatory criteria	Demonstration pp. 319-321	IDEM’s demonstration summarizes how the demonstration meets the requirements in the Exceptional Event Rule and meets the clear causal criteria.	Y

Not Reasonably Controllable or Preventable

The EER presumes that wildfire events on wildland are not reasonably controllable or preventable per 40 CFR § 50.14(b)(4). IDEM’s demonstration provided evidence that the wildfire events meet the definition of a wildfire. As the wildfires in the U.S. and Canada were reported to have been started by unplanned ignitions caused by lightning or prescribed fires that became out of control, they are considered wildfires. Additionally, IDEM demonstrated how fireworks emissions were caused by July Fourth celebrations, which is a cultural event as described in 40 § CFR 50.14(b)(2). Therefore, the documentation sufficiently demonstrates that the events were not reasonably controllable and not reasonably preventable.

Table 19: Not Reasonably Controllable or Preventable for the U.S. and Canadian Wildfires

Evidence	Demonstration Citation, if applicable	Summary of the EPA’s Review	Criterion Met?
Does the event meet the EER definition of a wildfire?	Demonstration p. 44, 71, 170, 200, 230, 278, 213 and Appendix A	The wildfires were caused by either prescribed fires that became out of control or natural factors such as lightning.	Y
Did the wildfire occur predominately on wildland as defined in the EER?	Demonstration p. 44, 71, 170, 200, 230, 278, 213 and Appendix A	Wildfires occurred in undeveloped areas across the U.S. and Canada, meeting the definition of wildland.	Y
Concluding Statement			
Inclusion of a concluding statement that explains how the demonstration meets the relevant statutory and regulatory criteria	Demonstration p. 44, 71, 170, 200, 230, 278, 213 and Appendix A	IDEM summarizes how the wildfire events were on wildland and not reasonably controllable or preventable.	Y

The EER states that fireworks displays that are significantly integral to traditional events, including the Fourth of July, shall be treated in the same manner as exceptional events [40 CFR § 50.14(b)(2)]. IDEM’s demonstration provided evidence that the exceedances recorded on July 4, 2023, were the result of Fourth of July fireworks displays. Therefore, this sufficiently demonstrates that the event should be treated as not reasonably controllable or preventable.

Table 20: Not Reasonably Controllable or Preventable for Fireworks

Evidence	Demonstration Citation, if applicable	Summary of the EPA’s Review	Criterion Met?
Does the event satisfy the EER requirements in 40 CFR § 50.14(b)(2) for fireworks displays?	Demonstration p. 258	The fireworks emissions were caused by July Fourth celebrations, which is a cultural event.	Y

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.” IDEM’s demonstration includes documentation that the events meet the definition of a wildfire and occurred predominantly on wildland, including satellite imagery, land-use maps, graphical data, media, and news reporting, demonstrating that the fires were unplanned and occurred in areas with little human activity or development. Additionally, IDEM demonstrated how fireworks emissions were caused by July Fourth celebrations, which is a cultural event as described in 40 CFR § 50.14(b)(2). IDEM has therefore shown that these events meet the EER criteria.

Table 21: Natural Event or Human Activity Unlikely to Recur at a Particular Location for Wildfires

Evidence	Demonstration Citation	Summary of the EPA’s Review	Criterion Met?
Does the event meet the EER definition of a wildfire?	Demonstration pp. 44-45, 72, 170-171, 204, 230-231, 278-279, and 312	The wildfires were unplanned ignitions caused by natural factors, as defined in the EER, or resulting from unexpected weather conditions affecting a preapproved prescribed burn. These fires that impacted the monitor also occurred on wildland.	Y
Concluding Statement			
Inclusion of a concluding statement that explains how the demonstration meets the relevant statutory and regulatory criteria	Demonstration pp. 44-45, 72, 170-171, 204, 230-231, 278-279, and 312	IDEM’s evidence demonstrated the fires were natural events occurring predominantly on wildland.	Y

Table 22: Natural Event or Human Activity Unlikely to Recur at a Particular Location for Fireworks

Evidence	Demonstration Citation	Summary of the EPA’s Review	Criterion Met?
Does the event satisfy the EER requirements in 40 CFR § 50.14(b)(2) for fireworks displays?	Demonstration p. 259	The fireworks emissions were caused by July Fourth celebrations, which is a cultural event.	Y

CONCLUSION

The EPA has reviewed the documentation provided by IDEM to support claims that fireworks emissions and smoke from wildfires in the U.S. and Canada caused exceedances of the 2024 annual PM_{2.5} standard at the Evansville - Buena Vista monitoring site on June 14-16, 2022, July 22, 2022, June 4, 2023, June 6-10, 2023, June 16-18, 2023, June 27-29, 2023, July 4, 2023, and September 7, 2023, and the Evansville - U of E monitoring site on June 16, 2022, July 22, 2022, June 8, 2023, and July 4, 2023. The EPA has determined that the flagged exceedances at these monitoring sites on these days satisfy the exceptional events 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. The EPA has also determined that the IDEM has satisfied the procedural requirements for data exclusion from comparison to the NAAQS.

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TECHNICAL SUPPORT DOCUMENT FOR THE EPA'S CONCURRENCE ON PM_{2.5} EXCEEDANCES MEASURED IN JEFFERSONVILLE, IN ON JUNE 14-16, 2022, JUNE 3-4, 2023, JUNE 6-10, 2023, JUNE 15-18, 2023, JUNE 27-29, 2023, JULY 4-5, 2023, AND JULY 16-17, 2023, AS EXCEPTIONAL EVENTS

On February 6, 2025, the Indiana Department of Environmental Management submitted an exceptional event demonstration for exceedances of the 2024 annual particulate matter with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers National Ambient Air Quality Standards that occurred at the Jeffersonville-Bates-Bowyer Ave, Clark County, Indiana (Air Quality System Monitor ID 18-019-0010) monitoring site. The demonstration submitted by IDEM states that the exceedances measured on these dates were caused by smoke entering the region from multiple wildfires in the U.S. and Canada or emissions from fireworks displays associated with the Fourth of July. Under the Exceptional Events Rule, air agencies can request the exclusion of event-influenced data, and the U.S. Environmental Protection Agency can concur to exclude these data, from the data set used for certain regulatory decisions. The remainder of this document summarizes the EER requirements, the subject events and the EPA's review of IDEM's submitted exceptional events demonstration.

EXCEPTIONAL EVENTS RULE REQUIREMENTS

The EPA promulgated the current EER in 2016, pursuant to Clean Air Act § 319. The EER added § 50.1(j)-(r), 50.14, and 51.930 to Title 40 of the Code of Federal Regulations. These sections contain definitions, criteria for the EPA's approval, procedural requirements, and requirements for air agency demonstrations. The 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 the EER criteria for the EPA to concur with excluding the air quality data from regulatory decisions. If the demonstration is found to not have regulatory significance, the EPA may defer making a concurrence determination.

Under 40 CFR § 50.14(c)(3)(iv), the air agency's 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 ("initial notification") and flagging of the affected data in the EPA's 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. We include below a summary of the EER criteria, including those identified in 40 CFR § 50.14(c)(3)(iv).

Regulatory Significance

The EER includes regulatory language that applies the provisions of CAA § 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 inadequacy leading to a SIP call; and other actions on a case-by-case basis as determined by the Administrator. Air agencies and the 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 the EPA's review.

Narrative Conceptual Model

The EER 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. Further, under 40 CFR § 50.14(a)(1)(i), the narrative conceptual model must describe the regulatory significance of the proposed data exclusion. For wildfire events, the EPA recommends that the narrative conceptual model also discuss emissions, meteorology, and pollutant transport. Air agencies may support the narrative conceptual model with summary tables or maps.

Clear Causal Relationship and Supporting Analyses

The EPA considers a variety of evidence when evaluating whether there is a clear causal relationship between a specific event and the monitored exceedance or violation. For wildfire PM_{2.5} events, air agencies should compare the PM_{2.5} data requested for exclusion with 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 PM_{2.5} exceedance or violation.

For wildfire PM_{2.5} events, the EPA has published the *PM_{2.5} Wildland Fire Exceptional Events Tiering Document* which provides three 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 the clear causal relationship for some wildfire events may be more explicit and/or extreme and, under the weight of evidence approach, may require relatively less evidence to satisfy the rule requirements.

² See the EPA's *PM_{2.5} Wildland Fire Exceptional Events Tiering Document*, April 2024 (the EPA's PM_{2.5} Tiering Document).

To determine the tier for an event, the air agency will first determine the tiering threshold for the monitor day. The tiering thresholds are based on the lesser value of either (a) the most recent 5-year month specific 98th percentile for 24-hour PM_{2.5} data, or (b) the minimum annual 98th percentile for 24-hour PM_{2.5} data for the most recent 5-year period. In calculating both (a) and (b), all data with any “Request Exclusion” (R) or fire-related “Informational Only” (I) qualifiers are excluded when using the *PM_{2.5} Tiering Tool* available on the EPA’s website. Air agencies are encouraged to evaluate their data carefully and consult with their EPA regional office about any data anomalies on a case-by-case basis. The EPA also retains its authority and discretion to evaluate data anomalies in submitted data and determine what tier is applicable for a candidate event.

- Tier 1:
 - **Key Factor for Tier 1 Analyses:** Distinct high levels of monitored 24-hour PM_{2.5} concentrations when compared to historical monthly or annual 24-hour levels of PM_{2.5}.
 - **Criteria:** Event-related exceedances should be greater than or equal to 1.5 times the tiering threshold as described for that candidate event day to be clearly distinguishable from non-event related concentrations.
 - In addition to the supporting analysis used to determine the Tier 1 criteria are met, the air agency should also supply at least one piece of additional evidence to support that the emissions from the fire were transported to the monitor location.
- Tier 2:
 - **Key Factor for Tier 2 Analyses:** High levels of monitored 24-hour PM_{2.5} concentrations, when compared to historical monthly or annual 24-hour levels of PM_{2.5}.
 - **Criteria:** Event-related exceedances are greater than or equal to the tiering threshold but less than 1.5 times the tiering threshold.
 - In addition to the evidence required for a Tier 1 analysis, the air agency should supply at least two additional pieces of evidence, one of which must be quantitative, to support a weight of evidence conclusion that it was the emissions from the wildfire, rather than other sources, that affected the monitored PM_{2.5} concentration.
- Tier 3:
 - **Key Factor for Tier 3 Analyses:** The relationship between the wildfire and the PM_{2.5} exceedance/violation is more complicated than the relationship in a Tier 2 analysis and thus would require more supporting documentation.
 - **Criteria:** Tier 3 demonstrations are appropriate when the measured 24-hour PM_{2.5} concentration is less than the tiering threshold and there are not any other extenuating circumstances or data anomalies that would point to a Tier 2 analysis being sufficient.
 - 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 PM_{2.5} exceedance.

Not Reasonably Controllable or Preventable

The EER 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 EER, an exceptional event must be “an event caused by human activity that is unlikely to recur at a particular location or a natural event.” The EER 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 would be needed 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.

THE EPA’S REVIEW OF EXCEPTIONAL EVENTS DEMONSTRATION

On November 22, 2024, IDEM submitted an Initial Notification of Potential Exceptional Events and on February 6, 2025, IDEM submitted an exceptional events demonstration. The demonstration is for 32 exceedances of the 2024 annual PM_{2.5} NAAQS but this TSD only evaluates those that occurred at the Jeffersonville-Bates-Bowyer Ave, Clark County, Indiana (AQS ID: 18-019-0010) monitoring site on June 14-16, 2022, June 3-4, 2023, June 6-10, 2023, June 15-18, 2023, June 27-29, 2023, July 4-5, 2023, and July 16-17, 2023, located within the Louisville/Jefferson County, KY-IN Core Based Statistical Area (CBSA).⁴ The EPA defers action on IDEM’s exceptional events requests for March 16, 2022, July 4, 2022, July 22-23, 2022, May 20, 2023, June 24, 2023, August 22-25, 2023, and September 7, 2023. The data for these days do not currently have regulatory significance and are lower concentrations.

Regulatory Significance

The EPA determined that exclusion of these exceedances of the PM_{2.5} standard have regulatory significance for initial area designations of the Louisville/Jefferson County, KY-IN CBSA for the 2024 annual PM_{2.5} NAAQS and worked with IDEM to identify the relevant exceedances, monitoring sites affected, and tiers. Table 1 summarizes these exceedances.

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 See Indiana-PM_{2.5} Exceptional Events Initial Notification-Jeffersonville

Table 1: Summary of Data Requested for Exclusion⁵

Exceedance Date	Monitoring Site Name	AQS ID	Monitored Concentration (µg/m ³)	Tier
June 14, 2022	Jeffersonville-Bates-Bowyer Ave	18-019-0010	23.6	1 ⁶
June 15, 2022	Jeffersonville-Bates-Bowyer Ave	18-019-0010	25.6	1
June 16, 2022	Jeffersonville-Bates-Bowyer Ave	18-019-0010	22.7	1 ⁶
June 3, 2023	Jeffersonville-Bates-Bowyer Ave	18-019-0010	18.8	1 ⁶
June 4, 2023	Jeffersonville-Bates-Bowyer Ave	18-019-0010	29.5	1
June 6, 2023	Jeffersonville-Bates-Bowyer Ave	18-019-0010	38.8	1
June 7, 2023	Jeffersonville-Bates-Bowyer Ave	18-019-0010	30.1	1
June 8, 2023	Jeffersonville-Bates-Bowyer Ave	18-019-0010	23.3	1 ⁶
June 9, 2023	Jeffersonville-Bates-Bowyer Ave	18-019-0010	27.9	1
June 10, 2023	Jeffersonville-Bates-Bowyer Ave	18-019-0010	25.1	1
June 15, 2023	Jeffersonville-Bates-Bowyer Ave	18-019-0010	43.5	1
June 16, 2023	Jeffersonville-Bates-Bowyer Ave	18-019-0010	24.1	1 ⁶
June 17, 2023	Jeffersonville-Bates-Bowyer Ave	18-019-0010	25.4	1
June 18, 2023	Jeffersonville-Bates-Bowyer Ave	18-019-0010	31.8	1
June 27, 2023	Jeffersonville-Bates-Bowyer Ave	18-019-0010	35.8	1
June 28, 2023	Jeffersonville-Bates-Bowyer Ave	18-019-0010	98.9	1
June 29, 2023	Jeffersonville-Bates-Bowyer Ave	18-019-0010	36.2	1
July 4, 2023	Jeffersonville-Bates-Bowyer Ave	18-019-0010	27.1	1
July 5, 2023	Jeffersonville-Bates-Bowyer Ave	18-019-0010	28.9	1
July 16, 2023	Jeffersonville-Bates-Bowyer Ave	18-019-0010	43.9	1
July 17, 2023	Jeffersonville-Bates-Bowyer Ave	18-019-0010	26.1	1

Concurrence on the exceedances listed in Table 1 would result in changing the design value for Louisville from 9.2 µg/m³ to 8.7 µg/m³ for 2022-2024. The design value reductions for this site would result in Louisville CBSA attaining the 2024 annual PM_{2.5} standard. Table 2 summarizes the effect of this exceptional events demonstration on the monitor’s design value.

⁵ See AQS Report AMP 355, Report Request ID: 2245085 dated December 11, 2024.

⁶ The EPA’s Tiering Tool categorized these days as Tier 2, but the EPA evaluated them as Tier 1 as they are part of a multi-day Tier 1 event.

Table 2: Summary of Regulatory Significance

Monitoring Site	Affected Regulatory Action	21-23 Design Value without the EPA's Concurrence (µg/m ³)	21-23 Design Value with the EPA's Concurrence (µg/m ³)	22-24 Design Value without the EPA's Concurrence (µg/m ³)	22-24 Design Value with the EPA's Concurrence (µg/m ³)
Jeffersonville-Bates-Bowyer Ave	Initial area designations determinations for the 2024 annual PM _{2.5} NAAQS	9.7	9.3	9.2	8.7

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 3 outlines the EPA's evaluation of these requirements.

Table 3: Procedural Criteria

Evidence	Demonstration Citation, if applicable	Summary of the EPA's Review	Criterion Met?
Did the agency appropriately flag the affected data in the EPA's Air Quality System?	Demonstration p. 12, Indiana-PM _{2.5} Exceptional Events Initial Notification-Jeffersonville	The EPA verified that IDEM applied request exclusion qualifiers to all PM _{2.5} monitors at the Jeffersonville-Bates-Bowyer Ave monitoring site on June 14-16, 2022, June 3-4, 2023, June 6-10, 2023, June 15-18, 2023, June 27-29, 2023, July 4-5, 2023, and July 16-17, 2023.	Y
Did the agency submit an Initial Notification?	Indiana-PM _{2.5} Exceptional Events Initial Notification-Jeffersonville	IDEM submitted the Initial Notification via email to the EPA on November 22, 2024.	Y

Evidence	Demonstration Citation, if applicable	Summary of the EPA's Review	Criterion Met?
Did the initial notification and demonstration submittals meet the deadlines for data influenced by exceptional events for use in initial area designations?	Demonstration p. 1, Indiana-PM _{2.5} Exceptional Events Initial Notification-Jeffersonville	IDEM submitted the Initial Notification to the EPA on November 22, 2024, and the final demonstration to the EPA on February 6, 2025.	Y
Was the 30-day public comment process followed and documented?	Demonstration p. 506, Attachment A	IDEM solicited, reviewed, and documented public comments per 40 CFR § 50.14(c)(3)(v). The comment period was open from December 6, 2024, to January 5, 2025.	Y
Did the agency submit to the EPA, and address in their demonstration, any public comments received?	Attachment A	No public commentary was received.	Y

Mitigation Requirements

IDEM is not subject to mitigation planning requirements under 40 CFR § 51.930(b) for these events and the 2024 annual PM_{2.5} NAAQS.

Narrative Conceptual Model

IDEM's demonstration provided a narrative conceptual model for each event to describe how emissions from wildfires and fireworks caused PM_{2.5} exceedances at the Jeffersonville-Bates-Bowyer Ave monitoring station.

The conceptual model for these events is supported by media reports, daily average PM_{2.5} concentration plots overlaid with the National Oceanic and Atmospheric Administration's Hazard Mapping System smoke plumes and active fire locations in AirNow-Tech, surface and upper air meteorological maps, and Canadian Wildland Information System active fire maps. These analyses support the conclusion that wildfire smoke was the primary contributor to the PM_{2.5} exceedances recorded at the Jeffersonville-Bates-Bowyer Ave monitoring site on June 14-16, 2022, June 3-4, 2023, June 6-10, 2023, June 15-18, 2023, June 27-29, 2023, and July 16-17, 2023. IDEM's analyses also support the conclusion that fireworks emissions were the primary contributor to the PM_{2.5} exceedances recorded at the Jeffersonville-Bates-Bowyer Ave monitoring site monitoring site on July 4-5, 2023.

The discussion of the interaction of wildfire smoke formation, fireworks, and meteorology resulting in impacts at the monitors in the Jeffersonville area is consistent with the EPA's recommendations (Guidance on the Preparation of Exceptional Events Demonstrations for Wildfire Events that May Influence Ozone Concentrations (EPA, 2016), PM_{2.5} Wildland Fire Exceptional Events Tiering Document

(EPA, 2024) and 40 CFR § 50.14(b)(2)). The regulatory significance of the proposed data exclusion is also discussed (see demonstration, pp. 1, 5-13, 506-509), as required by 40 CFR § 50.14(c)(3)(i).

June 14-16, 2022, Narrative Conceptual Model Overview

In June of 2022, there were active wildfires scattered throughout the Midwest, southern U.S., and southwestern U.S. and by June 14, 2022, there was a concentration of smoke in Jeffersonville, IN from the New Mexico, Arkansas, Missouri and the Mississippi River valley area. IDEM’s demonstration describes how a low-pressure system in the four corner states lifted out into the Central Plains and a large upper-level ridge was developing over the southeastern U.S. On June 14, 2022, a strong low-pressure system over Nebraska and a large surface high pressure over the southeastern U.S. drove strong dry winds up the plains and northward into the Ohio Valley, funneling wildfire smoke from New Mexico, Arkansas, Missouri, western Mississippi, and the panhandle of Florida to southwest Indiana. These meteorological features created a southwesterly flow pattern that transported wildfire smoke from the southern region to the eastern U.S. including the Jeffersonville, IN area through the entire period. Surface maps, pollution-rose, and Hybrid Single-Particle Lagrangian Integrated Trajectory analyses support IDEM’s demonstration narrative.

Table 4: Narrative Conceptual Model for June 14-16, 2022

Evidence	Demonstration Citation	Summary of the EPA’s Review	Criterion Met?
Description of event(s) causing exceedance or violation	Demonstration pp. 54-55	IDEM described wildfire complexes in New Mexico and the southcentral U.S. which caused PM _{2.5} exceedances on June 14-16, 2022.	Y
Discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s)	Demonstration pp. 55-65	IDEM included meteorological surface and upper air (500 and 850 mb heights) analyses as well as visible satellite imagery depicting wildfire smoke, which aligned with PM _{2.5} concentrations at ground level.	Y

Evidence	Demonstration Citation	Summary of the EPA's Review	Criterion Met?
Discusses the interaction of emissions and meteorology	Demonstration pp. 55-62, 66-71	IDEM included meteorological surface and upper air (500 and 850 mb heights) analyses as well as visible satellite imagery depicting wildfire smoke, which aligned with PM _{2.5} concentrations at ground level. HYSPLIT trajectory analyses were also provided with back trajectories that showed wildfire smoke transport from areas of wildfire activity in New Mexico and the southcentral U.S..	Y
Explains regulatory significance	Demonstration pp. 1, 5-13, 506-509	IDEM explained these days are regulatory significant for area designations for the 2024 annual PM _{2.5} NAAQS.	Y

June 3-4, 2023, and June 6-10, 2023, Narrative Conceptual Model Overview

Throughout the event, moderate to heavy fire danger conditions were reported across regions of Canada, with significant, out of control wildfire activity recorded in Quebec and southeastern Canada. IDEM's demonstration describes an upper-level high-pressure system over the northern plains and western Great Lakes throughout the June 3-4, 2023, and June 6-10, 2023, periods as well as a surface low pressure over the state of Maine. These two features contributed to the northerly wind flow that was maintained throughout the June 3-4, 2023, and June 6-10, 2023, periods. In addition, there were cold front passages on June 4, 2023, and June 6, 2023, in the Jeffersonville area. After the second cold front passed through on June 6, 2023, to the south, surface high pressure settled northwest of the Jeffersonville area which allowed the continual transport of Canadian wildfire smoke from Quebec and southeastern Canada to a wide swath of the Midwest, including Jeffersonville, IN. The HYSPLIT analyses show northerly transport from Canadian wildfires for June 3-4, 2023, and June 6-10, 2023, which supports the meteorological transport narrative in the demonstration.

Table 5: Narrative Conceptual Model for June 3-4, 2023, and June 6-10, 2023

Evidence	Demonstration Citation	Summary of the EPA's Review	Criterion Met?
Description of event(s) causing exceedance or violation	Demonstration pp. 185-186	IDEM described wildfire complexes in Quebec and southeast Canada which caused PM _{2.5} exceedances on June 3-4, 2023, and June 6-10, 2023.	Y

Evidence	Demonstration Citation	Summary of the EPA's Review	Criterion Met?
Discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s)	Demonstration pp. 186-209	IDEM included meteorological surface and upper air (500 and 850 mb heights) analyses as well as visible satellite imagery depicting wildfire smoke, which aligned with PM _{2.5} concentrations at ground level.	Y
Discusses the interaction of emissions and meteorology	Demonstration pp. 186-196	IDEM included daily average PM _{2.5} concentration plots overlaid with the NOAA's HMS smoke plumes and active fire locations in AirNow-Tech, surface and upper air meteorological maps, Canadian Wildland Information System and Fire Information for Resource Management System active fire maps, and a meteorological narrative describing how the wildfire emissions from Canada were transported to the Jeffersonville area.	Y
Explains regulatory significance	Demonstration pp. 1, 5-13, 506-509	IDEM explained these days are regulatory significant for area designations for the 2024 annual PM _{2.5} NAAQS.	Y

June 15-18, 2023, Narrative Conceptual Model Overview

Throughout the event, moderate to heavy fire danger conditions were reported across regions of Canada, with significant, out of control wildfire activity recorded in Quebec and Ontario. IDEM's demonstration describes a cold front on June 15, 2023, that moved south across the area from the northwest while Canadian high pressure was building over the state. Behind the cold front, wildfire smoke was transported into the area under the influence of surface high pressure and an upper air ridge to the west. The flow from these meteorological features allowed transport of Canadian wildfire smoke from Quebec to a wide swath of the Midwest, including Jeffersonville, IN. The building high-pressure system allowed the smoke to build up in the area causing elevated PM_{2.5} concentrations in Jeffersonville. The June 15-18, 2023, HYSPLIT analyses intersected the source regions of the Canadian wildfires, which supports the meteorological transport narrative in the demonstration.

Table 6: Narrative Conceptual Model for June 15-18, 2023

Evidence	Demonstration Citation	Summary of the EPA's Review	Criterion Met?
Description of event(s) causing exceedance or violation	Demonstration pp. 248-249	IDEM described wildfire complexes in Quebec and Ontario which caused PM _{2.5} exceedances on June 15-18, 2023.	Y
Discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s)	Demonstration pp. 250-254, 260-268	IDEM included meteorological surface and upper air (500 and 850 mb heights) analyses as well as visible satellite imagery depicting wildfire smoke, which aligned with PM _{2.5} concentrations at ground level. HYSPLIT trajectory analyses were also provided with back trajectories that showed wildfire smoke transport from areas of wildfire activity in Quebec and Ontario, Canada.	Y
Discusses the interaction of emissions and meteorology	Demonstration pp. 250-260	IDEM included daily average PM _{2.5} concentration plots overlaid with the NOAA's HMS smoke plumes and active fire locations in AirNow-Tech, surface and upper air meteorological maps, Canadian Wildland Information System and Fire Information for Resource Management System active fire maps, and a meteorological narrative describing how the wildfire emissions from Canada were transported to the Jeffersonville area.	Y

Evidence	Demonstration Citation	Summary of the EPA's Review	Criterion Met?
Explains regulatory significance	Demonstration pp. 1, 5-13, 506-509	IDEM explained these days are regulatory significant for area designations for the 2024 annual PM _{2.5} NAAQS.	Y

June 27-29, 2023, Narrative Conceptual Model Overview

Throughout the event, extreme fire danger conditions were reported across regions of Canada, with significant, out of control wildfire activity recorded in Quebec. IDEM's demonstration describes a low-pressure system over the eastern portion of the U.S. with a high pressure settling in over the Hudson Bay. The flow around these two meteorological features allowed transport of Canadian wildfire smoke from Quebec to a wide swath of the eastern U.S., including Jeffersonville, IN. The building high-pressure system allowed the smoke to build up in the area causing elevated PM_{2.5} concentrations in Jeffersonville. These meteorological features allowed transport and stagnation of Canadian wildfire smoke into eastern portions of the U.S., including Jeffersonville, IN. The June 27-29, 2023, HYSPLIT analyses intersected the source regions of the Canadian wildfires which supports the meteorological transport narrative in the demonstration.

Table 7: Narrative Conceptual Model for June 27-29, 2023

Evidence	Demonstration Citation	Summary of the EPA's Review	Criterion Met?
Description of event(s) causing exceedance or violation	Demonstration pp. 318-325	IDEM described wildfire complexes in Quebec and Ontario which caused PM _{2.5} exceedances on June 27-29, 2023.	Y
Discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s)	Demonstration pp. 318-325	IDEM included meteorological surface and upper air (500 and 850 mb heights) analyses as well as visible satellite imagery depicting wildfire smoke, which aligned with PM _{2.5} concentrations at ground level.	Y

Evidence	Demonstration Citation	Summary of the EPA's Review	Criterion Met?
Discusses the interaction of emissions and meteorology	Demonstration pp. 318-325	IDEM included daily average PM _{2.5} concentration plots overlaid with the NOAA's HMS smoke plumes and active fire locations in AirNow-Tech, surface and upper-level meteorological maps, Canadian Wildland Information System active fire maps, and a meteorological narrative describing how the wildfire emissions from Canada were transported to the Jeffersonville area.	Y
Explains regulatory significance	Demonstration pp. 1, 5-13, 506-509	IDEM explained these days are regulatory significant for initial area designations for the 2024 annual PM _{2.5} NAAQS.	Y

July 4-5, 2023, Narrative Conceptual Model Overview

IDEM's demonstration describes fireworks impacts on July 4-5, 2023, due to the Fourth of July holiday causing elevated PM_{2.5} concentrations during the evening hours on July 4, 2023, and into the morning hours of July 5, 2023, at the Jeffersonville-Bates-Bowyer Ave monitor. There were three public fireworks displays within five miles of the monitor. On July 4, 2023, spikes in PM_{2.5} concentrations were evident beginning at 8:00 pm on July 4, 2023, and lasting through the overnight hours into the morning of July 5, 2023. The hourly data peaked at 90.1 ug/m³ on July 5, 2023, at 12:00 am for the Jeffersonville-Bates-Bowyer Ave monitor. As the fireworks associated emissions lingered in the area due to stagnant conditions associated with a surface high pressure, the PM_{2.5} levels remained elevated at the Jeffersonville-Bates-Bowyer Ave monitor until the late morning hours of July 5, 2023. These meteorological conditions hindered the dispersion of the fireworks emissions until winds picked up the next day when daytime heating and mixing began.

Table 8: Narrative Conceptual Model for July 4-5, 2023

Evidence	Demonstration Citation	Summary of the EPA's Review	Criterion Met?
Description of event(s) causing exceedance or violation	Demonstration pp. 377, 387-388	IDEM described three public fireworks displays within five miles of the Jeffersonville monitor which caused PM _{2.5} exceedances on July 4-5, 2023.	Y
Discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s)	Demonstration pp. 377-380, 384-386	IDEM included meteorological surface and upper air (500 and 850 mb heights) analyses as well as hourly PM _{2.5} and carbon concentrations.	Y
Discusses the interaction of emissions and meteorology	Demonstration pp. 377-380, 387-388	IDEM included daily average PM _{2.5} concentration plots, surface and upper air (500 and 850 mb heights) meteorological maps, and a meteorological narrative describing how the fireworks emissions affected the Jeffersonville monitor.	Y
Explains regulatory significance	Demonstration pp. 1, 5-13, 506-509	IDEM explained these days are regulatory significant for initial area designations for the 2024 annual PM _{2.5} NAAQS.	Y

July 16-17, 2023, Narrative Conceptual Model Overview

Leading up to and throughout the event, active fires continued burning in the British Columbia and Alberta provinces in Canada. IDEM's demonstration describes a front which brought Canadian wildfire smoke from southwestern Canada to the Jeffersonville-Bates-Bowyer Ave monitor on July 16-17, 2023. This front eventually pushed through Jeffersonville on July 18, 2023, which finally cleared out the residual smoke later in the day. Upper-level maps also strongly support northwesterly flow from southwestern Canada into the Jeffersonville, IN area. These meteorological features allowed transport of Canadian wildfire smoke into the Jeffersonville area on July 16-17, 2023. The July 16-17, 2023, HYSPLIT analyses intersected the source regions of the Canadian wildfires which supports the meteorological transport narrative in the demonstration.

Table 9: Narrative Conceptual Model for July 16-17, 2023

Evidence	Demonstration Citation	Summary of the EPA's Review	Criterion Met?
Description of event(s) causing exceedance or violation	Demonstration pp. 391-400	IDEM described wildfire complexes in British Columbia and Alberta, Canada which caused PM _{2.5} exceedances on July 16-17, 2023.	Y
Discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s)	Demonstration pp. 391-400	IDEM included meteorological surface and upper air (500 and 850 mb heights) analyses as well as visible satellite imagery depicting wildfire smoke, which aligned with PM _{2.5} concentrations at ground level.	Y
Discusses the interaction of emissions and meteorology	Demonstration pp. 391-400	IDEM included daily average PM _{2.5} concentration plots overlaid with the NOAA's HMS smoke plumes and active fire locations in AirNowTech, surface and upper air (500 and 850 mb heights) meteorological maps, Canadian Wildland Information System active fire maps, and a meteorological narrative describing how the wildfire emissions from Canada were transported to the Jeffersonville area.	Y
Explains regulatory significance	Demonstration pp. 1, 5-13, 506-509	IDEM explained this day is regulatory significant elevated PM _{2.5} concentrations.	Y

Clear Causal Relationship and Supporting Analyses

IDEM's demonstration included the EPA's Tiering Tool analysis, comparison of event days with historical concentrations, HYSPLIT trajectory analyses (forward and backward), Aerosol Optical Depth and visible satellite imagery, NOAA's HMS smoke plumes and active fire locations in AirNow-Tech, General Additive Model, High-Resolution Rapid Refresh-Smoke model, BlueSky smoke model, carbon and PM_{2.5} timeseries, media articles, IDEM air quality forecasts, and NOAA Satellite Smoke Narrative to demonstrate the clear causal relationship between wildfire smoke or fireworks emissions and the

monitors in the Jeffersonville area. Based on the measured PM_{2.5} values, as well as other criteria, the days described in this TSD for which the EPA is concurring on, are Tier I events.

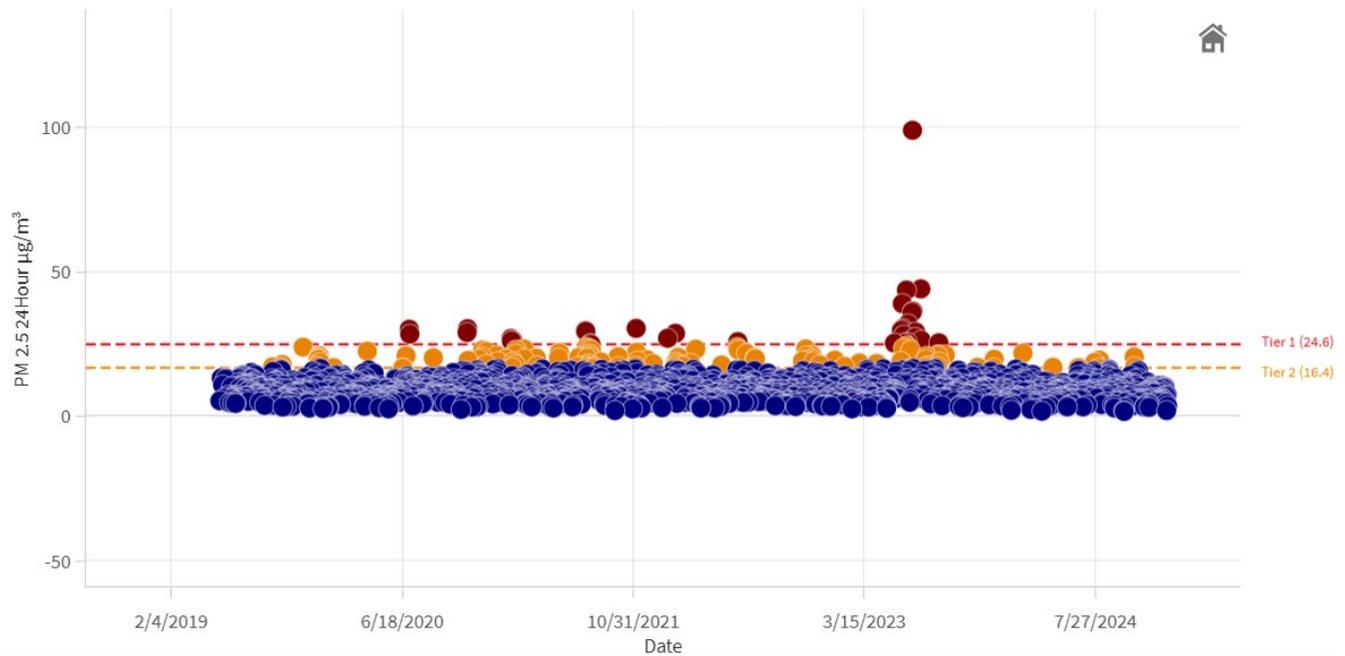
Comparison with Historical Concentrations

The demonstration includes a comparison with historical concentrations, as required by 40 CFR § 50.14(c)(3)(iv)(C). The demonstration compares daily average PM_{2.5} concentrations during the wildfire smoke and fireworks events on June 14-16, 2022, June 3-4, 2023, June 6-10, 2023, June 15-18, 2023, June 27-29, 2023, July 4-5, 2023, and July 16-17, 2023, 5-year average which illustrate the enhancement of PM_{2.5} concentrations on the event days compared to monitor concentrations during the rest of the year. As shown in Figures 1 and 2 below, daily concentrations of exceedance days for the monitor are compared to the Tier 1 cutoff for justification of the demonstration's tier selection.

Figure 1: The EPA's PM_{2.5} Tiering Tool for Exceptional Events Analysis, June

AQS Site ID 180190010

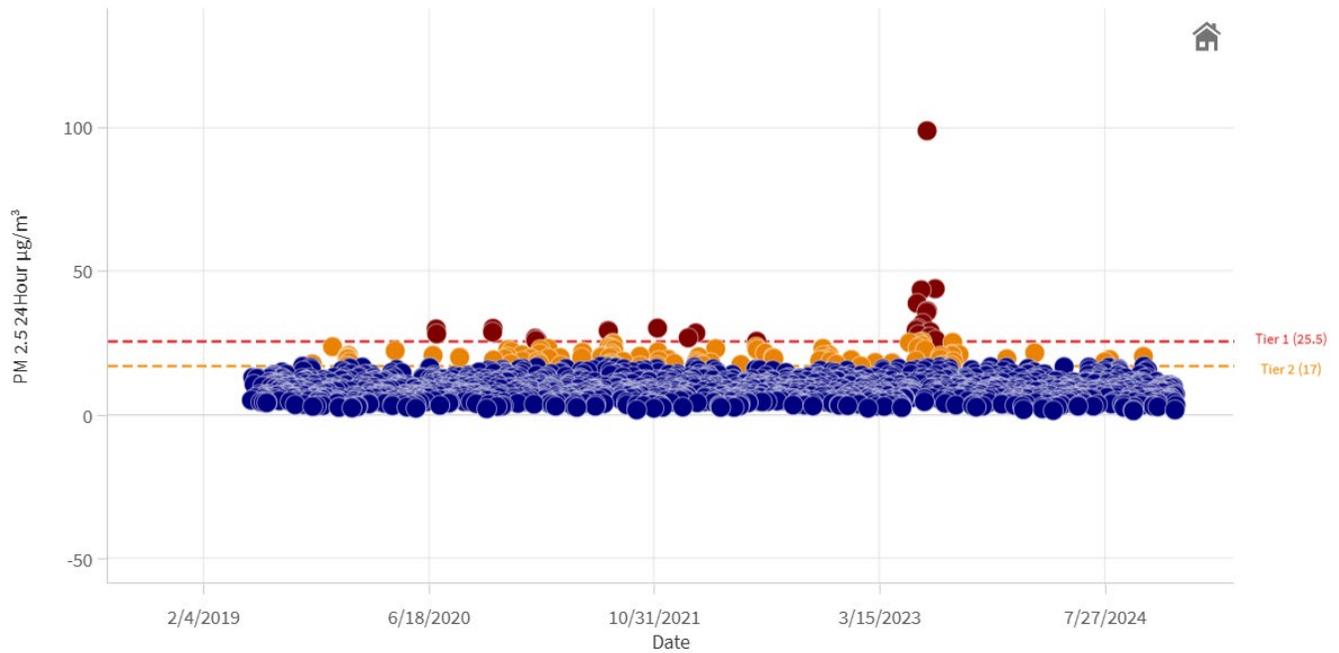
R and I Fire Flags Excluded From Tiering Calculation



AQS data last updated 4/24/2025

Figure 2: The EPA’s PM2.5 Tiering Tool for Exceptional Events Analysis, July

AQS Site ID 180190010
 R and I Fire Flags Excluded From Tiering Calculation



AQS data last updated 4/24/2025

Table 10: Summary of Tiering for Relevant Monitoring Days

Tiering	Demonstration Citation	Tiering Details	Tiers
Tiering for Jeffersonville-Bates-Bowyer Ave, Jeffersonville, Clark County, Indiana (AQS Monitor ID 18-019-0010) monitoring site on June 14-16, 2022, June 3-4, 2023, June 6-10, 2023, June 15-18, 2023, June 27-29, 2023, July 4-5, 2023, and July 16-17, 2023.	Demonstration pp. 6-12	IDEM cited the EPA’s Tiering Tool. Flags excluded from the calculation included R and I Fire Flags. The tiering thresholds were determined by analyzing the full 5-year dataset from 2019-2023.	1

June 14-16, 2022

Evidence of Transport of Wildfire Emissions from the Wildfire to the Monitors

For the exceedances on June 14-16, 2022, IDEM’s demonstration presents evidence of smoke transport from multiple fires in the U.S. (northern New Mexico and Arizona, southern and southeastern states including the Mississippi River valley area) to the Jeffersonville area (see demonstration, pp. 66-76, Figs. 2.2.14-2.2.22). Analyses are supported by forward and backward HYSPLIT trajectories overlaid on PM_{2.5} concentrations, smoke contours, and fire data (see demonstration, pp. 66-69, Figs. 2.2.14-2.1.16), and

are accompanied by AOD and visible satellite imagery (see demonstration, pp. 70-71, Figs. 2.2.17-2.2.19), HRRR-Smoke vertically integrated model outputs (see demonstration, pp. 72-74, Fig. 2.2.20), BlueSky Smoke Forecast model outputs (see demonstration, pp. 74-75, Fig. 2.2.21), and GAM analyses (see demonstration, p. 78, Fig. 2.2.22). HYSPLIT trajectories provided by IDEM illustrate transport of smoke from the southcentral U.S., including the Mississippi River valley area, to the Jeffersonville area on June 14-16, 2022. Smoke is also evident on the satellite imagery.

Evidence that the Wildfire Emissions Affected the Monitors

The PM_{2.5} concentration maps, GAM analyses, and carbon concentration timeseries show the transport of smoke from the southcentral U.S. fires to Jeffersonville and depict the smoke impacts at the monitor level from June 14-16, 2023 (see demonstration, pp. 63-65 and 76-81, Figs. 2.2.10-2.2.13 and 2.2.22-2.2.25). Additionally, IDEM included media articles, NOAA Satellite Smoke text products, and IDEM air quality forecasts discussing the wildfire plume impacts in the southcentral U.S. as well as Jeffersonville (see demonstration, pp. 85 - 94).

Table 11: Clear Causal Relationship for June 14-16, 2022

Evidence	Demonstration Citation, if applicable	Summary of the EPA’s Review	Criterion Met?
Comparison of Event-Related and Historical Concentrations⁷			
Tiering Tool plots across 5-years (2019-2023) and daily average PM _{2.5} concentration plots	Demonstration pp. 1-13, 55, Figs. 1.6, 2.2.1	PM _{2.5} concentrations on June 14-16, 2023, exceeded 1.5 times the Tiering Threshold, confirming Tier 1 and distinct elevated concentrations.	Y

⁷The EPA’s Guidance Prescribed Fire on Wildland that May Influence Ozone and Particulate Matter Concentrations (Prescribed Fire Guidance) offers examples of analyses that may be used to satisfy the comparison to historical concentrations criterion for wildland fires that may have influenced PM concentrations, including: Comparison of concentration on the claimed event day(s) with a set of similar days, a percentile of event-related concentration(s) relative to annual and/or seasonal data; 99th percentile over 5 years or fourth highest within one year; Description of past high data points labeled as being associated with previous exceptional events, suspected exceptional events, other unusual occurrences, or high pollution days due to normal emissions, with basic evidence to support claims and recognition that a history of concentrations above the standard could indicate additional evidence needed; Indication of how typically observed non-event diurnal or seasonal pattern differs, if such a deviation occurred, due to the event, with more weight given to effective statistical summaries that characterize non-event, high-concentration day historical data and the differences seen on event days over anecdotal or general assertions.

Evidence	Demonstration Citation, if applicable	Summary of the EPA’s Review	Criterion Met?
Evidence that the Fire Emissions were Transported to the Monitor(s)⁸			
HYSPLIT Trajectories, Satellite Imagery (AOD, visible, HMS smoke plumes, and detections of active fires in U.S.), the HRRR-Smoke model, and the BlueSky model	Demonstration pp. 66-75, Figs. 2.2.14-2.2.21	HYSPLIT trajectories (backward and forward), satellite imagery, HRRR-Smoke model outputs, and BlueSky model outputs demonstrated smoke transport from across the U.S. to Jeffersonville on June 14-16, 2022.	Y
Evidence that the Fire Emissions Affected the Monitor(s)⁹			
PM _{2.5} surface concentrations, GAM analyses, carbon concentration timeseries, media articles, and NOAA smoke narratives	Demonstration pp. 63-65, 76-82, 85-94, Figs. 2.2.10-2.2.13, 2.2.22-2.2.26	Spatial distribution of PM _{2.5} across the Midwest demonstrates regional impacts of wildfire smoke at the ground level on June 14-16, 2022. Additionally, IDEM’s GAM analyses, carbon concentration timeseries, media articles, and NOAA smoke narratives show the wildfire smoke plume impacts at the surface.	Y
Concluding Statement			
Inclusion of a concluding statement that explains how the demonstration meets the relevant statutory and regulatory criteria	Demonstration p. 94-95, 506-509	IDEM’s demonstration summarizes how the demonstration meets the requirements in the Exceptional Event Rule and meets the clear causal criteria.	Y

June 3-4, 2023, and June 6-10, 2023

Evidence of Transport of Wildfire Emissions from the Wildfire to the Monitors

For the exceedances on June 3-4, 2023, and June 6-10, 2023, IDEM’s demonstration presents evidence of smoke transport from Quebec and southeastern Canadian wildfires to the Jeffersonville area (see demonstration, pp. 205-226, Figs. 2.6.16-2.6.38). Analyses are supported by forward and backward HYSPLIT trajectories overlaid on PM_{2.5} concentrations, smoke contours, and the fire data (see

⁸The EPA’s Prescribed Fire Guidance offers examples of analyses that may be used to show emissions transport from wildland fires that may have influenced PM concentrations, including: Atmospheric trajectory analysis/modeling; Satellite imagery of plume with evidence of plume impacting the ground; Satellite imagery of plume with evidence of plume impacting the ground; Provision of additional information, such as analyses of relevant meteorological conditions (e.g., wind speed and direction at the height of the smoke plume) further supporting the clear causal relationship rule element.

demonstration, pp. 209-217, Figs. 2.6.23-2.6.29), AOD and visible satellite imagery (see demonstration, pp. 218 – 221, Figs. 2.6.30-2.6.36), HRRR-Smoke model analyses (see demonstration, pp. 221-224, Fig. 2.6.37), and GAM analyses (see demonstration, pp. 224-226, Fig. 2.6.38). HYSPLIT trajectories provided in IDEM’s demonstration illustrate transport of smoke from southeastern Canada to the Jeffersonville area. Smoke is also evident on the visible satellite imagery.

Evidence that the Wildfire Emissions Affected the Monitors

The PM_{2.5} concentration maps, GAM analyses, and carbon concentration timeseries show the transport of smoke from Canadian wildfires to Jeffersonville and depict the smoke impacts at the monitor level on June 3-4, 2023, and June 6-10, 2023 (see demonstration, pp. 206-209 and 224-236, Figs. 2.6.16-2.6.22 and 2.6.38-2.4.40). Additionally, IDEM included media articles, NOAA Satellite Smoke text products, and IDEM air quality forecasts discussing the wildfire plume impacts in the eastern U.S. as well as Jeffersonville (see demonstration, pp. 238-247).

Table 12: Clear Causal Relationship for on June 3-4, 2023, and June 6-10, 2023

Evidence	Demonstration Citation, if applicable	Summary of the EPA’s Review	Criterion Met?
Comparison of Event-Related and Historical Concentrations			
Tiering Tool plots across 5-years (2019-2023) and daily average PM _{2.5} concentration plots	Demonstration pp. 5-13, 186, Figs. 1.6, 2.6.1	PM _{2.5} concentrations on June 3-4, 2023, and June 6-10, 2023, exceeded 1.5 times the Tiering Threshold, confirming Tier 1 and distinct elevated concentrations.	Y
Evidence that the Fire Emissions were Transported to the Monitor(s)			
HYSPLIT Trajectories, Satellite Imagery (AOD, visible, HMS smoke plumes, and detections of active fires in Canada), and the HRRR-Smoke model	Demonstration pp. 209-224, Figs. 2.6.23-2.6.37	HYSPLIT trajectories (backward and forward), satellite imagery, and HRRR-Smoke model outputs (vertically integrated and near-surface) demonstrated smoke transport from Quebec and southeastern Canada to Jeffersonville on June 3-4, 2023, and June 6-10, 2023.	Y

Evidence	Demonstration Citation, if applicable	Summary of the EPA's Review	Criterion Met?
Evidence that the Fire Emissions Affected the Monitor(s)			
PM _{2.5} surface concentrations, GAM analyses, carbon concentration timeseries, media articles, NOAA smoke narratives, and IDEM air quality forecasts	Demonstration pp. 205-209, 224-247, Figs. 2.6.16-2.6.22, 2.6.38 - 2.4.40	Spatial distribution of PM _{2.5} across the Midwest demonstrates regional impacts of wildfire smoke at the ground level on June 3-4, 2023, and June 6-10, 2023. Additionally, IDEM's GAM analyses, carbon concentration timeseries, media articles, NOAA smoke narratives, and IDEM air quality forecasts show the wildfire smoke plume impacts at the surface.	Y
Concluding Statement			
Inclusion of a concluding statement that explains how the demonstration meets the relevant statutory and regulatory criteria	Demonstration pp. 247-248, 506-509	IDEM's demonstration summarizes how the demonstration meets the requirements in the Exceptional Event Rule and meets the clear causal criteria.	Y

June 15-18, 2023

Evidence of Transport of Wildfire Emissions from the Wildfire to the Monitors

For the exceedances on June 15-18, 2023, IDEM's demonstration presents evidence of smoke transport from the Quebec and Ontario wildfires to the Jeffersonville area (see demonstration, pp. 260-271, Figs. 2.7.16-2.7.25). Analyses are supported by forward and backward HYSPLIT trajectories overlaid on PM_{2.5} concentrations, smoke contours, and fire data (see demonstration, pp. 261-265, Figs. 2.7.16-2.7.19), AOD and visible satellite imagery (see demonstration, pp. 265-268, Figs. 2.7.20-2.7.23), HRRR-Smoke model analyses (see demonstration, pp. 268-270, Fig. 2.7.24), and GAM analyses (see demonstration, pp. 270-271, Fig. 2.7.25). The EPA further analyzed forward and backward trajectories for June 15-18, 2023, and demonstrated transport of smoke from southeastern Canada (see Figures 3-6 below). HYSPLIT trajectories from IDEM's demonstration in addition to trajectories analyzed by the EPA, as well as visible satellite imagery, illustrate transport of smoke from eastern Canada (Quebec and Ontario) to the Jeffersonville area on June 15-18, 2023.

Figure 3: Backward trajectories at 100-, 500-, and 1,000-meter heights starting on June 15, 2023, at 6:00 PM CDT from Jeffersonville and forward trajectories at 100-, 500-, and 1,000-meter heights starting on June 12, 2023, at 6:00 PM CDT. Trajectories were developed in AirNow-Tech's Navigator tool and the map was overlaid with hourly PM_{2.5} concentrations, HMS Fire satellite detected hotspots, and visual satellite imagery from June 15, 2023, at 6:00 PM CDT.

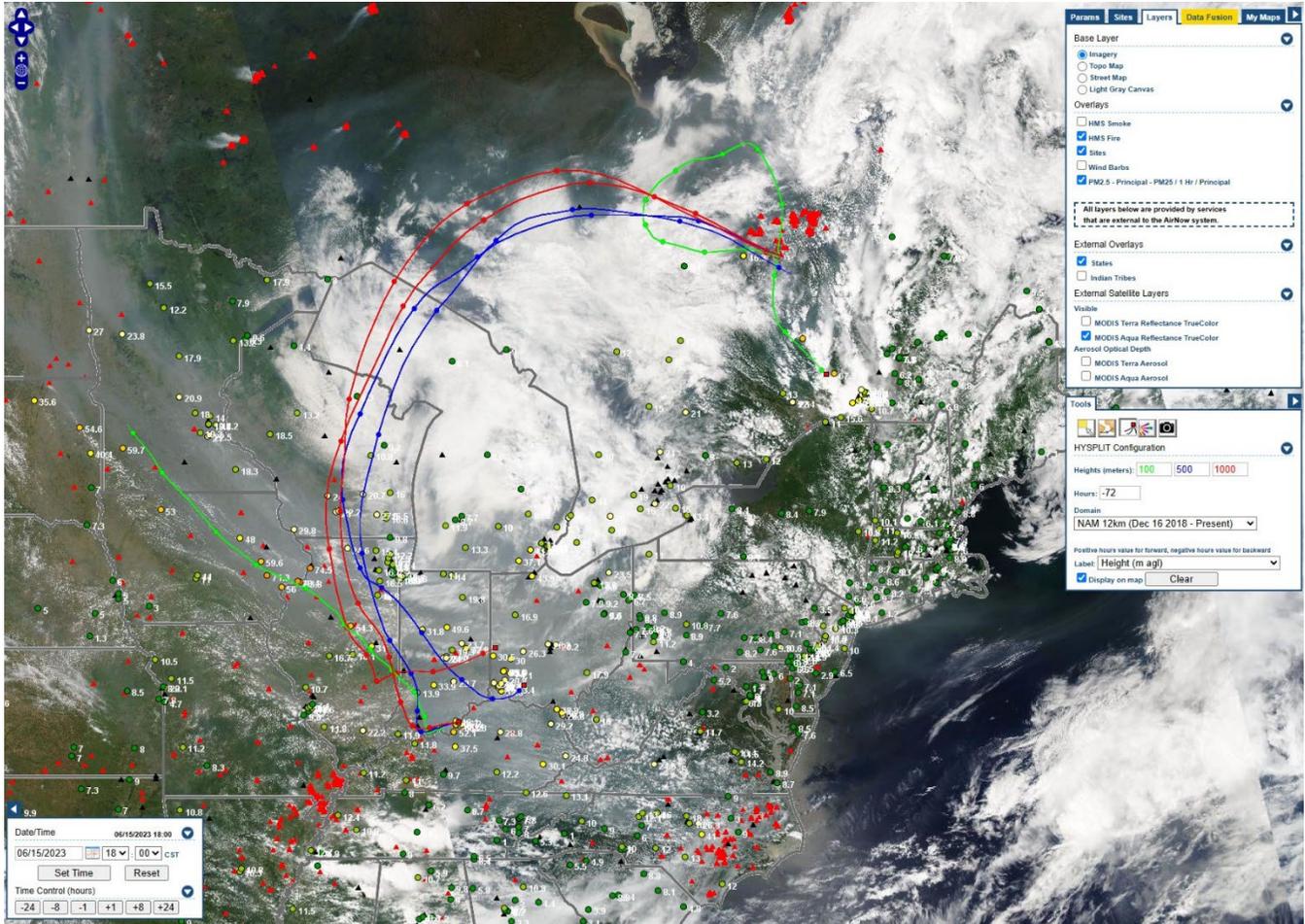


Figure 4: Backward trajectories at 100-, 500-, and 1,000-meter heights starting on June 16, 2023, at 6:00 AM CDT from Jeffersonville. Trajectories were developed in AirNow-Tech's Navigator tool and the map was overlaid with hourly PM_{2.5} concentrations, HMS Fire satellite detected hotspots, and satellite imagery from June 16, 2023, at 6:00 AM CDT.

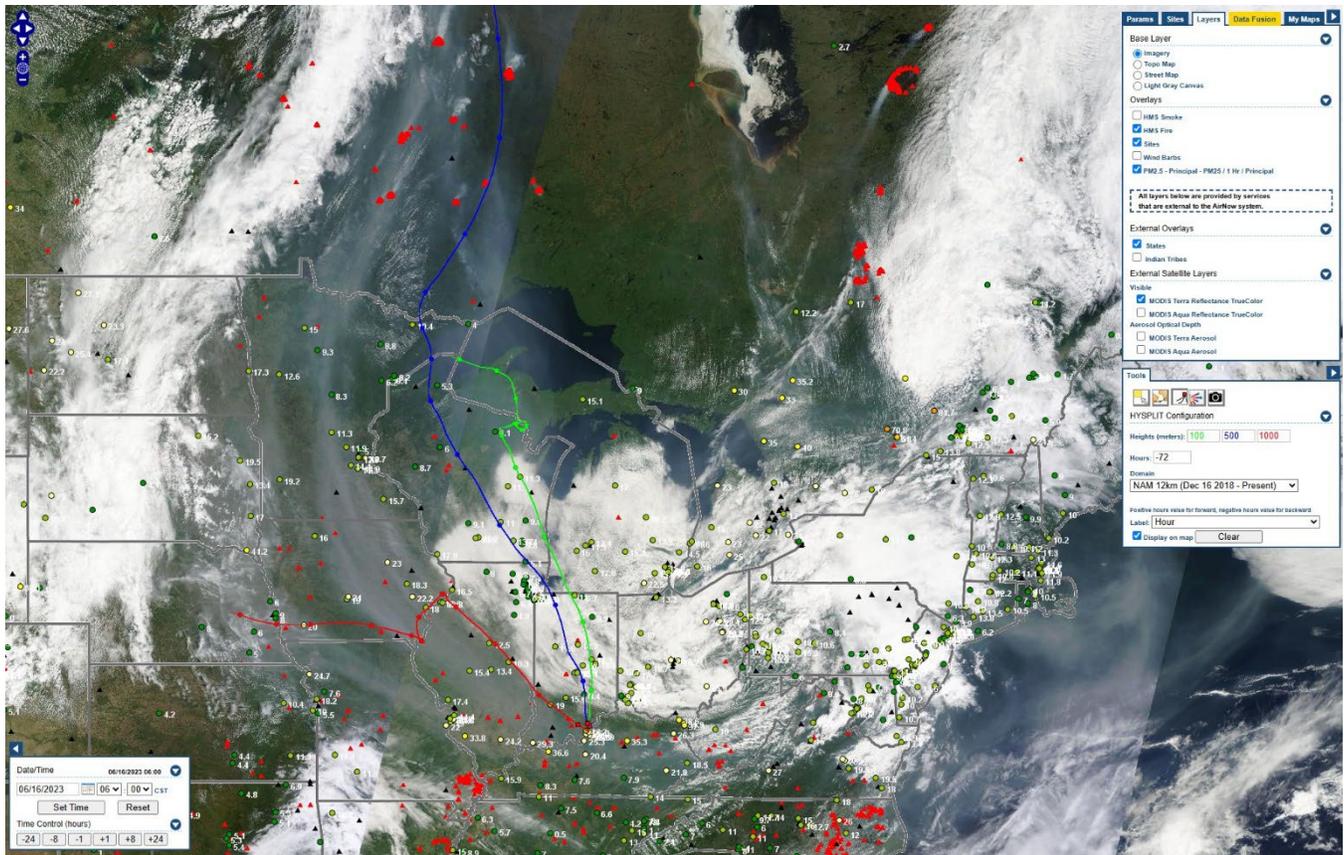


Figure 5: Backward trajectories at 100-, 500-, and 1,000-meter heights starting on June 17, 2023, at 8:00 PM CDT from Jeffersonville and forward trajectories at 100-, 500-, and 1,000-meter heights starting on June 15, 2023, at 4:00 AM CDT. Trajectories were developed in AirNow-Tech’s Navigator tool and the map was overlaid with hourly PM_{2.5} concentrations, HMS Fire satellite detected hotspots, and visual satellite imagery from June 15, 2023, at 4:00 PM CDT.

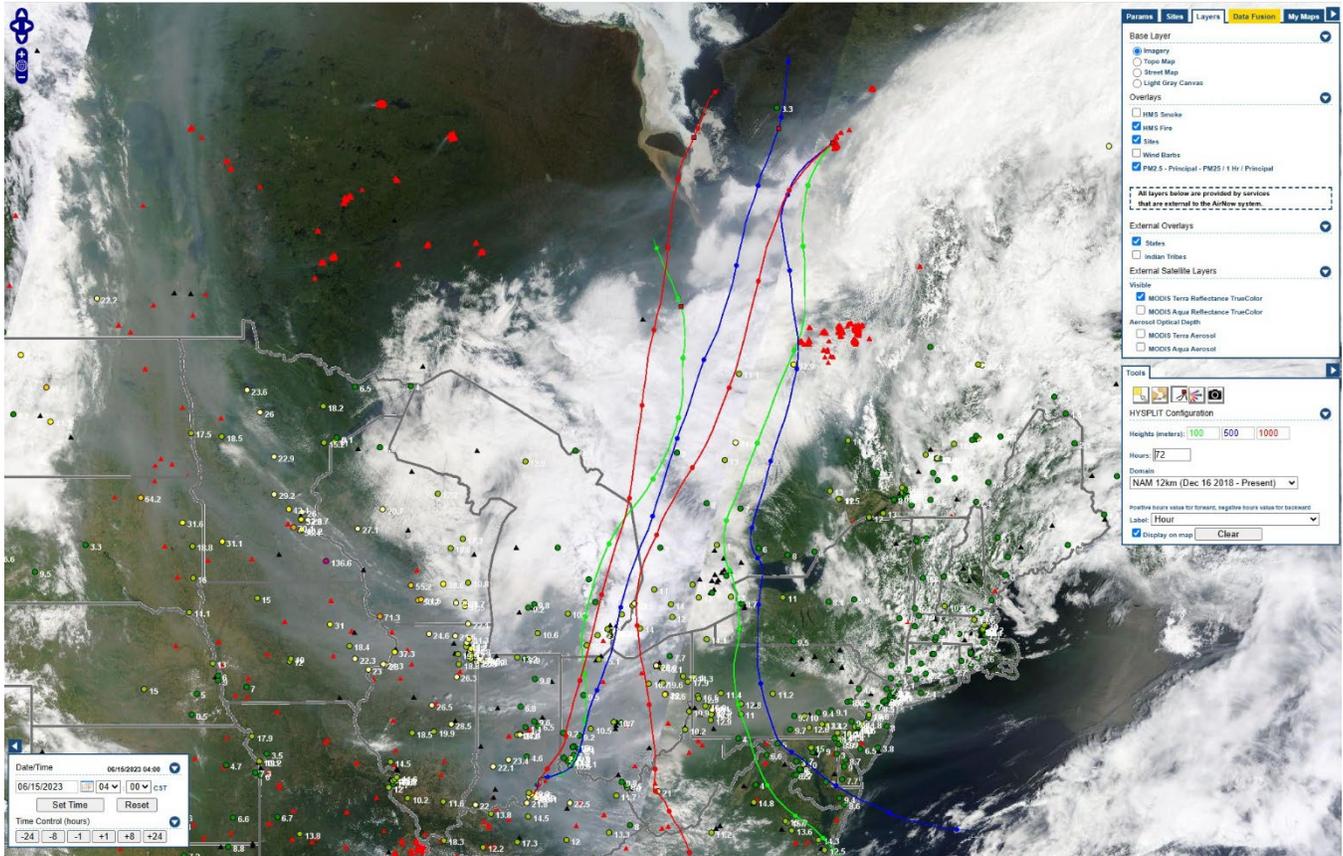
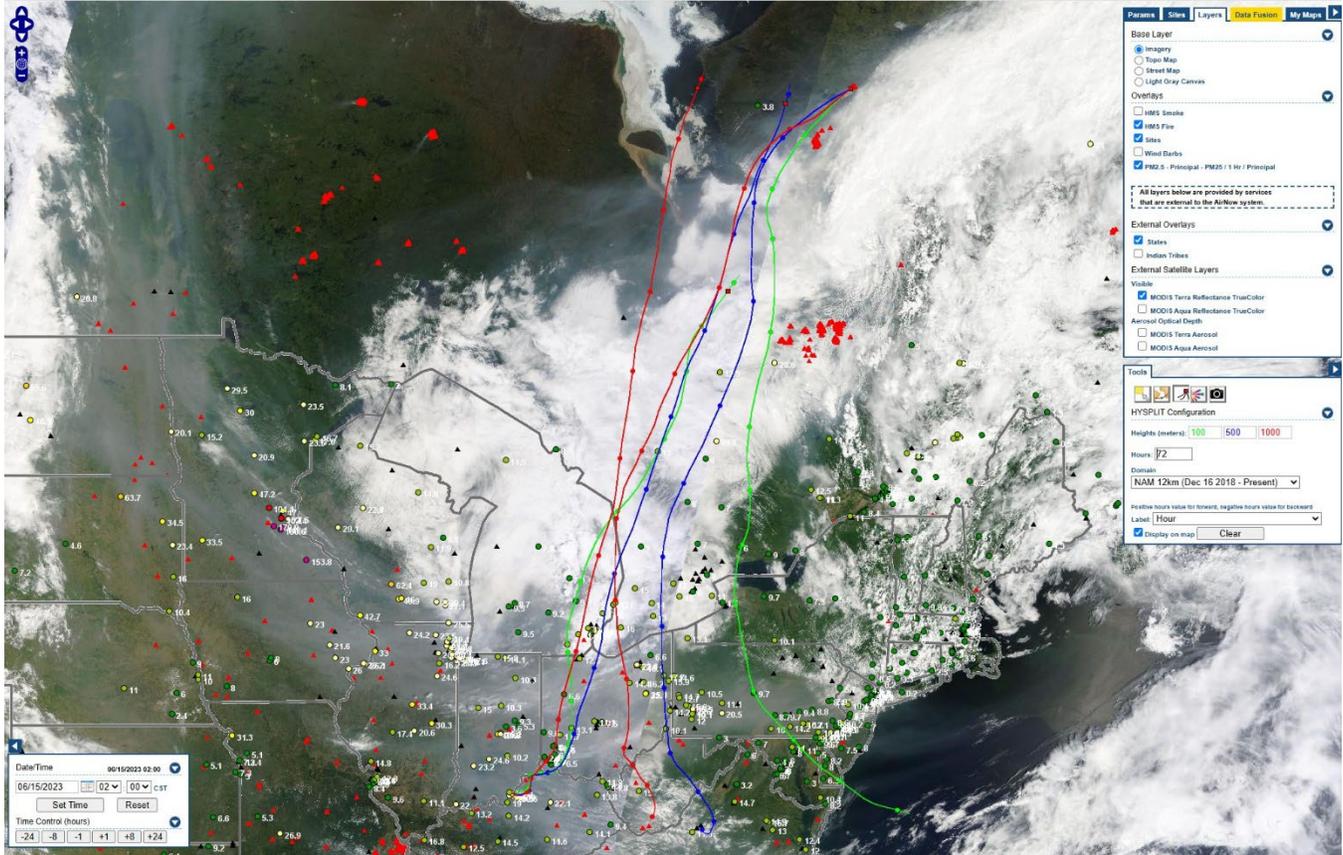


Figure 6: Backward trajectories at 100-, 500-, and 1,000-meter heights starting on June 18, 2023, at 12:00 AM CDT from Jeffersonville and forward trajectories at 100-, 500-, and 1,000-meter heights starting on June 15, 2023, at 2:00 AM CDT. Trajectories were developed in AirNow-Tech’s Navigator tool and the map was overlaid with hourly PM_{2.5} concentrations, HMS Fire satellite detected hotspots, and visual satellite imagery from June 15, 2023, at 4:00 PM CDT.



Evidence that the Wildfire Emissions Affected the Monitors

The PM_{2.5} concentration maps, GAM analyses, and carbon concentration timeseries show the transport of the smoke from Canadian wildfires to Jeffersonville and depict the smoke impacts at the monitor level on June 15-18, 2023 (see demonstration, pp. 258-260 and 270-276, Figs. 2.7.12-2.7.15 and 2.7.25-2.7.27). Additionally, IDEM included media articles, NOAA Satellite Smoke Text Products, and IDEM air quality forecasts and discussions that discussed the wildfire plume impacts in the U.S. as well as Jeffersonville (see demonstration, pp. 282-289).

Table 13: Clear Causal Relationship for on June 15-18, 2023

Evidence	Demonstration Citation, if applicable	Summary of the EPA’s Review	Criterion Met?
Comparison of Event-Related and Historical Concentrations			
Tiering Tool plots across 5-years (2019-2023) and daily average PM2.5 concentration plots	Demonstration pp. 5-13, 249, Figs. 1.6 and 2.7.1	PM _{2.5} concentrations on June 15-18, 2023, exceeded 1.5 times the Tiering Threshold, confirming Tier 1 and distinct elevated concentrations.	Y
Evidence that the Fire Emissions were Transported to the Monitor(s)			
HYSPLIT Trajectories, Satellite Imagery (AOD, visible, HMS smoke plumes, and detections of active fires in Canada), and the HRRR-Smoke model	Demonstration pp. 261-271, Figs. 2.7.16-2.7.24, 3-6	HYSPLIT trajectories (backward and forward), satellite imagery, and HRRR-Smoke model outputs (vertically integrated and near-surface) demonstrated smoke transport from Quebec and southeastern Canada to Jeffersonville on June 15-18, 2023.	Y
Evidence that the Fire Emissions Affected the Monitor(s)			
PM2.5 surface concentrations, GAM analyses, carbon concentration timeseries, media articles, NOAA smoke narratives, and IDEM air quality forecasts	Demonstration pp. 258-260, 270-276, 282-289, Figs. 2.7.12-2.7.15, 2.7.25-2.7.27	Spatial distribution of PM _{2.5} across the Midwest demonstrates regional impacts of wildfire smoke at the ground level on June 15-18, 2023. Additionally, IDEM’s GAM analyses, carbon concentration timeseries, media articles, NOAA smoke narratives, and IDEM air quality forecasts show the wildfire smoke plume impacts at the surface.	Y
Concluding Statement			
Inclusion of a concluding statement that explains how the demonstration meets the relevant statutory and regulatory criteria	Demonstration pp. 289-290, 506-509	IDEM’s demonstration summarizes how the demonstration meets the requirements in the Exceptional Event Rule and meets the clear causal criteria.	Y

June 27-29, 2023

Evidence of Transport of Wildfire Emissions from the Wildfire to the Monitors

For the exceedances on June 27-29, 2023, IDEM’s demonstration presents evidence of smoke transport from Quebec wildfires to the Jeffersonville area (see demonstration, pp. 329-336, Figs. 2.9.12-2.9.19). Analyses are supported by forward and backward HYSPLIT trajectories overlaid on PM_{2.5} concentrations, smoke contours, and fire data (see demonstration, pp. 329-331, Figs. 2.9.12-2.9.14), AOD and visible satellite imagery (see demonstration, pp. 332-333, Figs. 2.9.15-2.9.17), HRRR-Smoke analyses (see demonstration, pp. 334-335, Fig. 2.9.18), and GAM analyses (see demonstration, p. 336, Fig. 2.9.19). HYSPLIT trajectories illustrate transport of smoke from eastern Canada to the Jeffersonville area on June 27-29, 2023. Smoke is also evident on the satellite imagery.

Evidence that the Wildfire Emissions Affected the Monitors

The PM_{2.5} concentration maps, GAM analyses, and carbon concentration timeseries show the transport of the smoke from Canadian wildfires to Jeffersonville and depict the smoke impacts at the monitor level leading up to and on June 27-29, 2023 (see demonstration, pp. 326-341, Figs. 2.9.9-2.9.11, 2.9.19-2.9.21). Additionally, IDEM included media articles, NOAA smoke narratives, and IDEM air quality forecasts discussing the wildfire plume impacts in the eastern U.S. as well as Jeffersonville (see demonstration, pp. 342-375).

Table 14: Clear Causal Relationship for on June 27-29, 2023

Evidence	Demonstration Citation, if applicable	Summary of the EPA’s Review	Criterion Met?
Comparison of Event-Related and Historical Concentrations			
Tiering Tool plots across 5-years (2019-2023) and daily average PM _{2.5} concentration plots	Demonstration pp. 5-13, 319, 337	PM _{2.5} concentrations on June 27-29, 2023, exceeded 1.5 times the Tiering Threshold, confirming Tier 1 and distinct elevated concentrations	Y
Evidence that the Fire Emissions were Transported to the Monitor(s)			
HYSPLIT Trajectories, Satellite Imagery (AOD, visible, HMS smoke plumes, and detections of active fires in Canada), and the HRRR-Smoke model	Demonstration pp. 329-335	HYSPLIT trajectories (backward and forward), satellite imagery, and the HRRR-Smoke model demonstrated smoke transport from Quebec to Jeffersonville on June 27-29, 2023.	Y

Evidence	Demonstration Citation, if applicable	Summary of the EPA's Review	Criterion Met?
Evidence that the Fire Emissions Affected the Monitor(s)			
PM _{2.5} surface concentrations, GAM analyses, carbon concentration timeseries, media articles, NOAA smoke narratives, and IDEM air quality forecasts	Demonstration pp. 326-327, 335-375	Spatial distribution of PM _{2.5} across the Midwest demonstrates regional impacts of wildfire smoke at the ground level on June 27-29, 2023. Additionally, IDEM's GAM analyses, carbon concentration timeseries, media articles, NOAA smoke narratives, and IDEM air quality forecasts show the wildfire smoke plume impacts at the surface	Y
Concluding Statement			
Inclusion of a concluding statement that explains how the demonstration meets the relevant statutory and regulatory criteria	Demonstration pp. 375-377, 506-507	IDEM's demonstration summarizes how the demonstration meets the requirements in the Exceptional Event Rule and meets the clear causal criteria	Y

July 4-5, 2023

For the exceedances on July 4-5, 2023, IDEM's demonstration presents evidence of fireworks impacts on July 4-5, 2023, due to three public fireworks displays within five miles of the monitor. These public fireworks displays took place on the same day as the first recorded exceedances at the Jeffersonville-Bates-Bowyer Ave monitor. The fireworks impacts are supported by hourly PM_{2.5} and carbon timeseries showing a clear spike in concentrations at 8:00 pm on July 4, 2023, and lasting throughout the early morning hours into July 5, 2023, as meteorological conditions were stagnant (see demonstration, pp. 377-380, 384-388).

Table 15: Clear Causal Relationship for on July 4-5, 2023

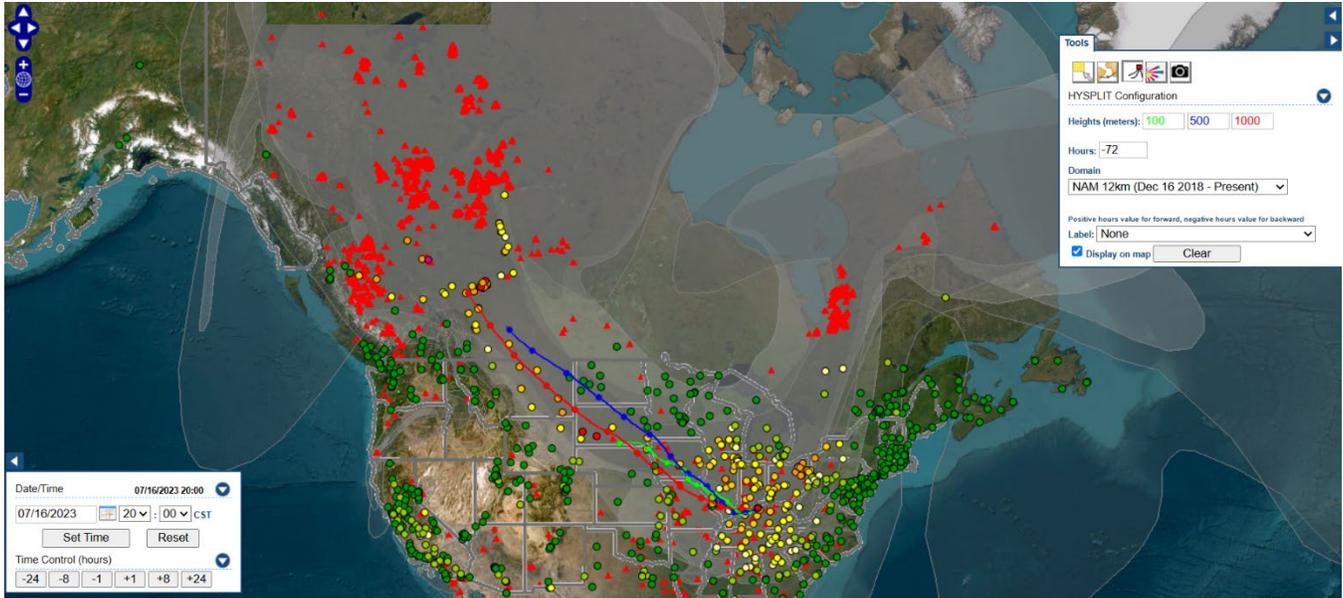
Evidence	Demonstration Citation, if applicable	Summary of the EPA’s Review	Criterion Met?
Comparison of Event-Related and Historical Concentrations			
Tiering Tool plots across 5-years (2019-2023) and daily average PM _{2.5} concentration plots	Demonstration pp. 5-13, 378, 384	PM _{2.5} concentrations on July 4-5, 2023, exceeded 1.5 times the Tiering Threshold, confirming Tier 1 and distinct elevated concentrations.	
Evidence that the Fire Emissions were Transported and Affected the Monitor(s)			
PM _{2.5} and carbon concentration timeseries, media articles	Demonstration pp. 377-380, 384-388, 391	The three public fireworks shows within five miles of the Jeffersonville monitor timing aligns with the spike of PM _{2.5} and carbon concentrations on July 4-5, 2023.	
Concluding Statement			
Inclusion of a concluding statement that explains how the demonstration meets the relevant statutory and regulatory criteria	Demonstration p. 391, 506-507	IDEM’s demonstration summarizes how the demonstration meets the requirements in the Exceptional Event Rule and meets the clear causal criteria.	

July 16-17, 2023

Evidence of Transport of Wildfire Emissions from the Wildfire to the Monitors

For the exceedances on July 16-17, 2023, IDEM’s demonstration presents evidence of smoke transport from British Columbia and Alberta wildfires to the Jeffersonville area (see demonstration, pp. 401-408, Figs. 2.11.11-2.11.16). Analyses are supported by forward and backward HYSPLIT trajectories overlaid on PM_{2.5} concentrations, smoke contours, and fire data (see demonstration, pp. 402-404, Figs. 2.11.11-2.11.12), AOD and visible satellite imagery (see demonstration, p. 405, Figs. 2.11.13-2.11.14), HRRR-Smoke analyses (see demonstration, pp. 406-407, Fig. 2.11.15), and GAM analyses (see demonstration, p. 408, Fig. 2.11.16). HYSPLIT trajectories illustrate transport of smoke from western Canada to the Jeffersonville area on July 16-17, 2023. Smoke is also evident on the satellite imagery. The EPA further analyzed backward trajectories for July 16, 2023, and demonstrated transport of smoke from fires in western Canada (see Fig. 7 below), which align with surface PM_{2.5} concentrations and HMS smoke plumes.

Figure 7: Backward trajectories at 250-, 500-, and 1,000-meter heights starting on July 16, 2023, at 09:00 AM CDT from Jeffersonville. The 20:00 hour on July 16, 2023, had the highest PM_{2.5} concentrations for the 24-hour period at the Jeffersonville-Bates-Bowyer Ave monitor. Trajectories were developed in AirNow-Tech’s Navigator tool and the map was overlaid with hourly PM_{2.5} concentrations, HMS fire satellite detected hotspots, and HMS smoke plumes from July 16, 2023.



Evidence that the Wildfire Emissions Affected the Monitors

The PM_{2.5} concentration maps, GAM analyses, and carbon concentration timeseries show the transport of the smoke from Canadian wildfires to Jeffersonville and depict the smoke impacts at the monitor level on July 16-17, 2023 (see demonstration, pp. 401-412, Figs. 2.11.9-2.11.18). Additionally, IDEM included media articles, NOAA smoke narratives, and IDEM air quality forecasts discussing the wildfire plume impacts in the eastern U.S. as well as Jeffersonville (see demonstration, pp. 413-425).

Table 16: Clear Causal Relationship for July 16-17, 2023

Evidence	Demonstration Citation, if applicable	Summary of the EPA’s Review	Criterion Met?
Comparison of Event-Related and Historical Concentrations			
Tiering Tool plots across 5-years (2019-2023) and daily average PM _{2.5} concentration plots	Demonstration pp. 5-13, 392, 408	PM _{2.5} concentrations on July 16-17, 2023, exceeded 1.5 times the Tiering Threshold, confirming Tier 1 and distinct elevated concentrations.	Y

Evidence	Demonstration Citation, if applicable	Summary of the EPA's Review	Criterion Met?
Evidence that the Fire Emissions were Transported to the Monitor(s)			
HYSPLIT Trajectories, Satellite Imagery (AOD, visible, HMS smoke plumes, and detections of active fires in Canada), and the HRRR-smoke model	Demonstration pp. 402-407	HYSPLIT trajectories (backward and forward), satellite imagery, and the HRRR-Smoke model demonstrated smoke transport from western Canada to Jeffersonville on July 16-17, 2023.	Y
Evidence that the Fire Emissions Affected the Monitor(s)			
PM _{2.5} surface concentrations, GAM analyses, carbon concentration timeseries, media articles, NOAA smoke narratives, and IDEM air quality forecasts	Demonstration pp. 408-425	Spatial distribution of PM _{2.5} across the Midwest demonstrates regional impacts of wildfire smoke at the ground level on July 16-17, 2023. Additionally, IDEM's GAM analyses, carbon concentration timeseries, media articles, NOAA smoke narratives, and IDEM air quality forecasts show the wildfire smoke plume impacts at the surface.	Y
Concluding Statement			
Inclusion of a concluding statement that explains how the demonstration meets the relevant statutory and regulatory criteria	Demonstration pp. 426-427, 321	IDEM's demonstration summarizes how the demonstration meets the requirements in the Exceptional Event Rule and meets the clear causal criteria.	Y

Not Reasonably Controllable or Preventable

The EER presumes that wildfire events on wildland are not reasonably controllable or preventable per 40 CFR § 50.14(b)(4). IDEM's demonstration provided evidence that the wildfire events meet the definition of wildfire. As the wildfires in the U.S. and Canada were reported to have been started by unplanned ignitions caused by lightning or prescribed fires that became out of control, they are considered wildfires. Additionally, IDEM

demonstrated how fireworks emissions were caused by July Fourth celebrations, which is a cultural event as described in 40 CFR § 50.14(b)(2). Therefore, the documentation sufficiently demonstrates that the event was not reasonably controllable and not reasonably preventable.

Table 17: Not Reasonably Controllable for the U.S. and Canadian Wildfires

Evidence	Demonstration Citation, if applicable	Summary of the EPA’s Review	Criterion Met?
Does the event meet the EER definition of a wildfire?	Demonstration pp. 84, 200, 238, 282, 351, 415	The wildfires were caused by natural factors such as lightning, or unexpected weather conditions affecting a preapproved prescribed burn.	Y
Did the wildfire occur predominately on wildland as defined in the EER?	Demonstration pp. 84, 238, 282, 351, 415	Wildfires occurred in undeveloped areas across the U.S. and Canada, meeting the definition of wildland.	Y
Concluding Statement			
Inclusion of a concluding statement that explains how the demonstration meets the relevant statutory and regulatory criteria	Demonstration pp. 84, 238, 282, 351, 415	IDEM summarizes how the wildfire events were on wildland and not reasonably controllable or preventable.	Y

The EER states that fireworks displays that are significantly integral to traditional events, including the Fourth of July, shall be treated in the same manner as exceptional events [40 CFR § 50.14(b)(2)]. IDEM’s demonstration provided evidence that the exceedances recorded on July 4-5, 2023, were the result of Fourth of July fireworks displays. Therefore, this sufficiently demonstrates that the event should be treated as not reasonably controllable or preventable.

Table 18: Not Reasonably Controllable or Preventable for Fireworks

Evidence	Demonstration Citation, if applicable	Summary of the EPA’s Review	Criterion Met?
Does the event satisfy the EER requirements in 40 CFR § 50.14(b)(2) for fireworks displays?	Demonstration pp. 389-390	The fireworks emissions were caused by July Fourth celebrations, which is a cultural event.	Y

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.” IDEM’s demonstration includes documentation that the events meet the definition of a wildfire and occurred predominantly on wildland, including satellite imagery, land-use maps, graphical data, media, and news reporting, demonstrating that the fires were unplanned and occurred

in areas with little human activity or development. Additionally, IDEM demonstrated how fireworks emissions were caused by July Fourth celebrations, which is a cultural event as described in 40 CFR § 50.14(b)(2). IDEM has therefore shown that these events meet the EER criteria.

Table 19: Natural Event or Human Activity Unlikely to Recur at a Particular Location for Wildfires

Evidence	Demonstration Citation	Summary of the EPA's Review	Criterion Met?
Does the event meet the EER definition of a wildfire?	Demonstration pp. 238, 282, 351, 415	The wildfires were unplanned ignitions caused by natural factors, as defined in the EER, or resulting from unexpected weather conditions affecting a preapproved prescribed burn. These fires that impacted the monitor also occurred on wildland.	Y
Concluding Statement			
Inclusion of a concluding statement that explains how the demonstration meets the relevant statutory and regulatory criteria	Demonstration pp. 238, 282, 351, 415	IDEM's evidence demonstrated the fires were natural events occurring predominantly on wildland.	Y

Table 20: Natural Event or Human Activity Unlikely to Recur at a Particular Location for Fireworks

Evidence	Demonstration Citation	Summary of the EPA's Review	Criterion Met?
Does the event satisfy the EER requirements in 40 CFR § 50.14(b)(2) for fireworks displays?	Demonstration p. 390	The fireworks emissions were caused by July Fourth celebrations, which is a cultural event.	Y

CONCLUSION

The EPA has reviewed the documentation provided by IDEM to support claims that fireworks emissions and smoke from wildfires in the U.S. and Canada caused exceedances of the 2024 annual PM_{2.5} standard at the Jeffersonville-Bates-Bowyer Ave, Jeffersonville, Clark County, Indiana (AQS ID: 18-019-0010) monitoring site on June 14-16, 2022, June 3-4, 2023, June 6-10, 2023, June 15-18, 2023, June 27-29, 2023, July 4-5, 2023, and July 16-17, 2023, located within the Louisville/Jefferson County, KY-IN CBSA. The EPA has determined that the flagged exceedances at these monitoring sites on these days satisfy the exceptional events 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. The EPA has also determined that IDEM has satisfied the procedural requirements for data exclusion from comparison to the NAAQS.

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TECHNICAL SUPPORT DOCUMENT FOR THE EPA'S CONCURRENCE ON PM_{2.5} EXCEEDANCES MEASURED IN TERRE HAUTE, IN ON JUNE 14-15, 2022, JULY 3, 2022, JUNE 5-7, 2023, JUNE 15, 2023, JUNE 17-18, 2023, JUNE 27-29, 2023, JULY 4, 2023, AND JULY 16-18, 2023, AS EXCEPTIONAL EVENTS

On January 22, 2025, the U.S. Environmental Protection Agency received the Indiana Department of Environmental Management's exceptional event demonstration, dated January 16, 2025. IDEM's exceptional event demonstration addresses exceedances of the 2024 annual particulate matter with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers National Ambient Air Quality Standards that occurred at the Terre Haute-Lafayette Avenue (Air Quality System ID: 18-167-0018) monitoring site on June 14-15, 2022, July 3, 2022, June 5-7, 2023, June 15, 2023, June 17-18, 2023, June 27-29, 2023, July 4, 2023, and July 16-18, 2023. The demonstration submitted by IDEM states that the exceedances measured on these dates were caused by smoke entering the region from multiple wildfires in the U.S. and Canada or emissions from fireworks displays associated with the Fourth of July. Under the Exceptional Events Rule, air agencies can request the exclusion of event-influenced data, and the EPA can concur to exclude these data, from the data set used for certain regulatory decisions. The remainder of this document summarizes the EER requirements, the subject events and the EPA's review of IDEM's submitted exceptional events demonstration.

EXCEPTIONAL EVENTS RULE REQUIREMENTS

The EPA promulgated the current EER in 2016, pursuant to Clean Air Act § 319. The EER added § 50.1(j)-(r), 50.14, and 51.930 to Title 40 of the Code of Federal Regulations. These sections contain definitions, criteria for the EPA's approval, procedural requirements, and requirements for air agency demonstrations. The 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 the EER criteria for the EPA to concur with excluding the air quality data from regulatory decisions. If the demonstration is found to not have regulatory significance, the EPA may defer making a concurrence determination.

Under 40 CFR § 50.14(c)(3)(iv), the air agency's 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 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."

1. submission of an Initial Notification of Potential Exceptional Event (“initial notification”) and flagging of the affected data in the EPA's 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 EER criteria, including those identified in 40 CFR § 50.14(c)(3)(iv).

Regulatory Significance

The EER includes regulatory language that applies the provisions of CAA § 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 inadequacy leading to a SIP call; and other actions on a case-by-case basis as determined by the Administrator. Air agencies and the 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 the EPA's review.

Narrative Conceptual Model

The EER 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. Further, under 40 CFR § 50.14(a)(1)(i), the narrative conceptual model must describe the regulatory significance of the proposed data exclusion. For wildfire events, the EPA recommends that the narrative conceptual model also discuss emissions, meteorology, and pollutant transport. Air agencies may support the narrative conceptual model with summary tables or maps.

Clear Causal Relationship and Supporting Analyses

The EPA considers a variety of evidence when evaluating whether there is a clear causal relationship between a specific event and the monitored exceedance or violation. For wildfire PM_{2.5} events, air agencies should compare the PM_{2.5} data requested for exclusion with 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 PM_{2.5} exceedance or violation.

For wildfire PM_{2.5} events, the EPA has published the *PM_{2.5} Wildland Fire Exceptional Events Tiering Document* which provides three 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 the

² See the EPA's PM_{2.5} *Wildland Fire Exceptional Events Tiering Document*, April 2024 (EPA's PM_{2.5} Tiering Document).

clear causal relationship for some wildfire events may be more explicit and/or extreme and, under the weight of evidence approach, may require relatively less evidence to satisfy the rule requirements.

To determine the tier for an event, the air agency will first determine the tiering threshold for the monitor day. The tiering thresholds are based on the lesser value of either (a) the most recent 5-year month specific 98th percentile for 24-hour PM_{2.5} data, or (b) the minimum annual 98th percentile for 24-hour PM_{2.5} data for the most recent 5-year period. In calculating both (a) and (b), all data with any "Request Exclusion" (R) or fire-related "Informational Only" (I) qualifiers are excluded when using the *PM_{2.5} Tiering Tool* available on the EPA's website. Air agencies are encouraged to evaluate their data carefully and consult with their EPA regional office about any data anomalies on a case-by-case basis. The EPA also retains its authority and discretion to evaluate data anomalies in submitted data and determine what tier is applicable for a candidate event.

- Tier 1:
 - **Key Factor for Tier 1 Analyses:** Distinct high levels of monitored 24-hour PM_{2.5} concentrations when compared to historical monthly or annual 24-hour levels of PM_{2.5}.
 - **Criteria:** Event-related exceedances should be greater than or equal to 1.5 times the tiering threshold as described for that candidate event day to be clearly distinguishable from non-event related concentrations.
 - In addition to the supporting analysis used to determine the Tier 1 criteria are met, the air agency should also supply at least one piece of additional evidence to support that the emissions from the fire were transported to the monitor location.
- Tier 2:
 - **Key Factor for Tier 2 Analyses:** High levels of monitored 24-hour PM_{2.5} concentrations, when compared to historical monthly or annual 24-hour levels of PM_{2.5}.
 - **Criteria:** Event-related exceedances are greater than or equal to the tiering threshold but less than 1.5 times the tiering threshold.
 - In addition to the evidence required for a Tier 1 analysis, the air agency should supply at least two additional pieces of evidence, one of which must be quantitative, to support a weight of evidence conclusion that it was the emissions from the wildfire, rather than other sources, that affected the monitored PM_{2.5} concentration.
- Tier 3:
 - **Key Factor for Tier 3 Analyses:** The relationship between the wildfire and the PM_{2.5} exceedance/violation is more complicated than the relationship in a Tier 2 analysis and thus would require more supporting documentation.
 - **Criteria:** Tier 3 demonstrations are appropriate when the measured 24-hour PM_{2.5} concentration is less than the tiering threshold and there are not any other extenuating circumstances or data anomalies that would point to a Tier 2 analysis being sufficient.
 - 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 PM_{2.5} exceedance.

Not Reasonably Controllable or Preventable

The EER 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 EER, an exceptional event must be “an event caused by human activity that is unlikely to recur at a particular location or a natural event.” The EER 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 would be needed 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.

THE EPA’S REVIEW OF EXCEPTIONAL EVENTS DEMONSTRATION

On October 15, 2024, IDEM submitted an Initial Notification of Potential Exceptional Events and on January 22, 2025, IDEM submitted an exceptional events demonstration, dated January 16, 2025. The demonstration is for 20 exceedances of the 2024 annual PM_{2.5} NAAQS but this TSD only evaluates those that occurred at the Terre Haute-Lafayette Avenue (AQS ID: 18-167-0018) monitoring site on June 14-15, 2022, July 3, 2022, June 5-7, 2023, June 15, 2023, June 17-18, 2023, June 27-29, 2023, July 4, 2023, and July 16-18, 2023, located within the Terre Haute, IN Core-Based Statistical Area.⁴ The EPA defers action on the exceptional event requests for March 16-17, 2022, August 24, 2023, and November 5, 2023. The data for these days do not currently have regulatory significance and are lower concentrations.

Regulatory Significance

The EPA determined that exclusion of these exceedances of the PM_{2.5} standard have regulatory significance for initial area designations of the Terre Haute CBSA for the 2024 annual PM_{2.5} NAAQS and worked with IDEM to identify the relevant exceedances, monitoring sites affected, and tiers. Table 1 summarizes these exceedances.

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.”

⁴See Indiana-PM_{2.5} Exceptional Events Initial Notification-Terre Haute.

Table 1: Summary of Data Requested for Exclusion⁵

Exceedance Date	Monitoring Site Name	AQS ID	Monitored Concentration (µg/m ³)	Tier
June 14, 2022	Terre Haute – Lafayette Avenue	18-167-0018	25.5	1
June 15, 2022	Terre Haute – Lafayette Avenue	18-167-0018	33.1	1
July 3, 2022	Terre Haute – Lafayette Avenue	18-167-0018	33.8	1
June 5, 2023	Terre Haute – Lafayette Avenue	18-167-0018	23.8	1
June 6, 2023	Terre Haute – Lafayette Avenue	18-167-0018	27.7	1
June 7, 2023	Terre Haute – Lafayette Avenue	18-167-0018	27.2	1
June 15, 2023	Terre Haute – Lafayette Avenue	18-167-0018	22.4	1 ⁶
June 17, 2023	Terre Haute – Lafayette Avenue	18-167-0018	27.1	1
June 18, 2023	Terre Haute – Lafayette Avenue	18-167-0018	30.1	1
June 27, 2023	Terre Haute – Lafayette Avenue	18-167-0018	74.3	1
June 28, 2023	Terre Haute – Lafayette Avenue	18-167-0018	156.8	1
June 29, 2023	Terre Haute – Lafayette Avenue	18-167-0018	28.6	1
July 4, 2023	Terre Haute – Lafayette Avenue	18-167-0018	33.1	1
July 16, 2023	Terre Haute – Lafayette Avenue	18-167-0018	42.5	1
July 17, 2023	Terre Haute – Lafayette Avenue	18-167-0018	22	1 ⁶
July 18, 2023	Terre Haute – Lafayette Avenue	18-167-0018	23.7	1 ⁶

Concurrence on the exceedances listed in Table 1 would result in changing the design value for Terre Haute – Lafayette Avenue from 9.3 µg/m³ to 8.8 µg/m³ for the 2022-2024 period. The design value reductions for this site would result in the Terre Haute CBSA attaining the 2024 annual PM_{2.5} standard. Table 2 summarizes the effect of this exceptional events demonstration on the monitor’s design value.

⁵ See AQS Report AMP 355, Report Request ID: 2282061 dated April 11, 2025.

⁶ The EPA’s Tiering Tool categorized these days as Tier 2, but the EPA evaluated them as Tier 1 as they are part of a multi-day Tier 1 event.

Table 2: Summary of Regulatory Significance

Monitoring Site	Affected Regulatory Action	21-23 Design Value without the EPA's Concurrence (µg/m ³)	21-23 Design Value with the EPA's Concurrence (µg/m ³)	22-24 Design Value without the EPA's Concurrence (µg/m ³)	22-24 Design Value with the EPA's Concurrence (µg/m ³)
Terre Haute – Lafayette Avenue	Initial area designations determinations for the 2024 annual PM _{2.5} NAAQS	9.5	9.1	9.3	8.8

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 3 outlines the EPA's evaluation of these requirements.

Table 3: Procedural Criteria

Evidence	Demonstration Citation, if applicable	Summary of the EPA's Review	Criterion Met?
Did the agency appropriately flag the affected data in the EPA's Air Quality System?	Demonstration pp. 11-12, Indiana-PM _{2.5} Exceptional Events Initial Notification-Terre Haute	The EPA verified that IDEM applied request exclusion qualifiers to all PM _{2.5} monitors at the Terre Haute-Lafayette Avenue monitoring site on June 14-15, 2022, July 3, 2022, June 5-7, 2023, June 15, 2023, June 17-18, 2023, June 27-29, July 4, 2023, and July 16-18, 2023.	Y
Did the agency submit an Initial Notification?	Indiana-PM _{2.5} Exceptional Events Initial Notification-Terre Haute	IDEM submitted the Initial Notification via email to the EPA on October 15, 2024.	Y
Did the initial notification and demonstration submittals meet the deadlines for data influenced by exceptional events for use in initial area designations?	Demonstration pp. 1-2, Indiana-PM _{2.5} Exceptional Events Initial Notification-Terre Haute	IDEM submitted the Initial Notification to the EPA on October 15, 2024, and the final demonstration to the EPA on January 22, 2025.	Y

Evidence	Demonstration Citation, if applicable	Summary of the EPA's Review	Criterion Met?
Was the 30-day public comment process followed and documented?	Demonstration p. 323, Attachment A	IDEM solicited, reviewed, and documented public comments per 40 CFR § 50.14(c)(3)(v). The comment period was open from November 6, 2024, to December 6, 2024.	Y
Did the agency submit to the EPA, and address in their demonstration, any public comments received?	Demonstration p. 323, Attachment A	No public commentary was received.	Y

Mitigation Requirements

IDEM is not subject to mitigation planning requirements under 40 CFR § 51.930(b) for these events and the 2024 annual PM_{2.5} NAAQS.

Narrative Conceptual Model

IDEM's demonstration provided a narrative conceptual model for each event to describe how emissions from wildfires and fireworks caused PM_{2.5} exceedances at the Terre Haute – Lafayette Avenue monitoring station.

The conceptual model for these events is supported by media reports, daily average PM_{2.5} concentration plots overlaid with the National Oceanic and Atmospheric Administration's Hazard Mapping System smoke plumes and active fire locations in AirNowTech, surface and upper air meteorological maps, and Canadian Wildland Information System active fire maps. These analyses support the conclusion that wildfire smoke or fireworks were the primary contributors to the PM_{2.5} exceedances recorded at the Terre Haute – Lafayette Avenue monitoring site on June 14-15, 2022, June 5-7, 2023, June 15, 2023, June 17-18, 2023, June 27-29, 2023, and July 16-18, 2023. IDEM's analyses also support the conclusion that fireworks emissions were the primary contributor to the PM_{2.5} exceedances recorded at Terre Haute – Lafayette Avenue monitoring site on July 3, 2022, and July 4, 2023.

The discussion of the interaction of wildfire smoke formation, fireworks emissions, and meteorology resulting in impacts at the monitor in the Terre Haute area is consistent with the EPA's recommendations (Guidance on the Preparation of Exceptional Events Demonstrations for Wildfire Events that May Influence Ozone Concentrations (EPA, 2016), PM_{2.5} Wildland Fire Exceptional Events Tiering Document (EPA, 2024) and 40 CFR § 50.14(b)(2)). The regulatory significance of the proposed data exclusion is also discussed (see demonstration, pp 6-12), as required by 40 CFR § 50.14(c)(3)(i).

June 14-15, 2022, Narrative Conceptual Model Overview

In June 2022, there were active wildfires scattered throughout the Midwest, southcentral and southwestern U.S. and by June 14th there was a concentration of smoke in Terre Haute, IN from the New Mexico, Arkansas, Missouri and the Mississippi River valley area. IDEM's demonstration describes

how a low-pressure system in the four corner states lifted out into the Central Plains and a large upper-level ridge was developing over the southeastern U.S. On June 14th, 2022, a strong low-pressure system over Nebraska and a large surface high pressure over the southeastern U.S. drove strong dry winds up the plains and northward into the Ohio Valley, funneling wildfire smoke from New Mexico, Arkansas, Missouri, western Mississippi, and the panhandle of Florida to southwest Indiana. These meteorological features created a southwesterly flow pattern that transported wildfire smoke from the southern region to the eastern U.S. including the Terre Haute, IN area through the entire period. The June 14-15, 2022, Hybrid Single-Particle Lagrangian Integrated Trajectory analyses intersected the source regions of the wildfires which supports the meteorological transport narrative in the demonstration.

Table 4: Narrative Conceptual Model for June 14-15, 2022

Evidence	Demonstration Citation	Summary of the EPA's Review	Criterion Met?
Description of event(s) causing exceedance or violation	Demonstration pp. 55-77	IDEM described wildfire complexes in New Mexico and the southcentral U.S. states which caused PM _{2.5} exceedances on June 14-15, 2022.	Y
Discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s)	Demonstration pp. 57-64	IDEM included meteorological surface and upper air (500 and 850 mb heights) analyses as well as visible satellite imagery depicting wildfire smoke, which aligned with PM _{2.5} concentrations at ground level.	Y
Discusses the interaction of emissions and meteorology	Demonstration pp. 57-67	IDEM included meteorological surface and upper air (500 and 850 mb heights) analyses as well as visible satellite imagery depicting wildfire smoke, which aligned with PM _{2.5} concentrations at ground level. HYSPLIT trajectory analyses were also provided with back trajectories that showed wildfire smoke transport from areas of wildfire activity in the U.S.	Y
Explains regulatory significance	Demonstration pp. 1, 6-18, 321-325	IDEM explained these days are regulatory significant for area designations for the 2024 annual PM _{2.5} NAAQS.	Y

July 3, 2022, Narrative Conceptual Model Overview

IDEM’s demonstration describes fireworks impacts on July 3, 2022, due to the Fourth of July holiday causing elevated PM_{2.5} concentrations during the evening hours at the Terre Haute - Lafayette Ave monitor. Fireworks were set off in nearby neighborhoods, Sycamore Winery, and the Bridge Church (<https://www.mywabashvalley.com/community/where-to-watch-fireworks-around-the-wabash-valley/>) on this day with spikes evident starting at 8:00 PM on July 3, 2022, and lasting through 11:00 PM. The hourly data peaked at 289.6 ug/m³ at 10:00 PM for the Terre Haute - Lafayette Ave monitor. As the fireworks associated emissions lingered in the area due to low winds, the PM_{2.5} levels remained elevated at the monitor until the early morning hours of July 4, 2022.

Table 5: Narrative Conceptual Model for July 3, 2022

Evidence	Demonstration Citation	Summary of the EPA’s Review	Criterion Met?
Description of event(s) causing exceedance or violation	Demonstration pp. 89, 96-97	IDEM included information on the Terre Haute main fireworks show which caused PM _{2.5} exceedances on July 3, 2022.	Y
Discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s)	Demonstration pp. 89-91, 93-94	IDEM included meteorological surface and upper air (500 and 850 mb heights) analyses as well as hourly PM _{2.5} and carbon concentrations.	Y
Discusses the interaction of emissions and meteorology	Demonstration pp. 89-91, 96-97	IDEM included daily average PM _{2.5} concentration plots, surface and upper air (500 and 850 mb heights) meteorological maps, and a meteorological narrative describing how the fireworks emissions affected the Terre Haute – Lafayette Ave monitor.	Y
Explains regulatory significance	Demonstration pp. 1, 6-18, 321-325	IDEM explained these days are regulatory significant for area designations for the 2024 annual PM _{2.5} NAAQS.	Y

June 5-7, 2023, Narrative Conceptual Model Overview

Throughout the event, moderate to heavy fire danger conditions were reported across regions of Canada, with significant, out of control wildfire activity recorded in Quebec and southeastern Canada. IDEM’s demonstration describes an upper-level high-pressure system over the northern plains and western Great Lakes throughout the June 5-7, 2023, period. In addition, there was a cold front passage on June 6, 2023, in the Terre Haute area. After the cold front passed through on June 6, 2023, to the south, surface high pressure settled northwest of the Terre Haute area which allowed the continual

transport of Canadian wildfire smoke from Quebec and southeastern Canada to a wide swath of the Midwest, including Terre Haute, IN. The HYSPLIT analyses intersected the source regions of the Canadian wildfires, which supports the meteorological transport narrative in the demonstration.

Table 6: Narrative Conception Model for June 5-7, 2023

Evidence	Demonstration Citation	Summary of the EPA's Review	Criterion Met?
Description of event(s) causing exceedance or violation	Demonstration pp. 97-112	IDEM described wildfire complexes in Quebec and southeast Canada which caused PM _{2.5} exceedances on June 5-7, 2023.	Y
Discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s)	Demonstration pp. 112-127	IDEM included meteorological surface and upper air (500 and 850 mb heights) analyses as well as visible satellite imagery depicting wildfire smoke, which aligned with PM _{2.5} concentrations at ground level.	Y
Discusses the interaction of emissions and meteorology	Demonstration pp. 98-112	IDEM included daily average PM _{2.5} concentration plots overlaid with the NOAA's HMS smoke plumes and active fire locations in AirNow-Tech, surface and upper air meteorological maps, Canadian Wildland Information System and Fire Information for Resource Management System active fire maps, and a meteorological narrative describing how the wildfire emissions from Canada were transported to the Terre Haute area.	Y
Explains regulatory significance	Demonstration pp. 1, 6-18, 321-325	IDEM explained these days are regulatory significant for area designations for the 2024 annual PM _{2.5} NAAQS.	Y

June 15, 2023, and June 17-18, 2023, Narrative Conceptual Model Overview

Throughout the event, moderate to heavy fire danger conditions were reported across regions of Canada, with significant, out of control wildfire activity recorded in Quebec and Ontario. IDEM’s demonstration describes a cold front on June 15, 2023, that moved south across the area from the northwest while Canadian high pressure was building over the state. Behind the cold front, wildfire smoke was transported into the area under the influence of surface high pressure and an upper air ridge to the west. The flow from these meteorological features allowed transport of Canadian wildfire smoke from Quebec to a wide swath of the Midwest, including Terre Haute, IN. The building high-pressure system allowed the smoke to build up in the area causing elevated PM_{2.5} concentrations in Terre Haute. The June 15, 2023, and June 17 – 18, 2023, HYSPLIT analyses intersected the source regions of the Canadian wildfires, which supports the meteorological transport narrative in the demonstration.

Table 7: Narrative Conceptual Model for June 15, 2023, and June 17-18, 2023

Evidence	Demonstration Citation	Summary of the EPA’s Review	Criterion Met?
Description of event(s) causing exceedance or violation	Demonstration pp. 135-161	IDEM described wildfire complexes in Quebec and Ontario which caused PM _{2.5} exceedances on June 15, 2023, and June 17 - 18, 2023.	Y
Discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s)	Demonstration pp. 136-148	IDEM included meteorological surface and upper air (500 and 850 mb heights) analyses as well as visible satellite imagery depicting wildfire smoke, which aligned with PM _{2.5} concentrations at ground level. HYSPLIT trajectory analyses were also provided with back trajectories that showed wildfire smoke transport from areas of wildfire activity in Quebec and Ontario, Canada.	Y

Evidence	Demonstration Citation	Summary of the EPA's Review	Criterion Met?
Discusses the interaction of emissions and meteorology	Demonstration pp. 136-145	IDEM included daily average PM _{2.5} concentration plots overlaid with the NOAA's HMS smoke plumes and active fire locations in AirNow-Tech, surface and upper air meteorological maps, Canadian Wildland Information System and Fire Information for Resource Management System active fire maps, and a meteorological narrative describing how the wildfire emissions from Canada were transported to the Terre Haute area.	Y
Explains regulatory significance	Demonstration pp. 1, 6-18, 321-325	IDEM explained these days are regulatory significant for area designations for the 2024 annual PM _{2.5} NAAQS.	Y

June 27-29, 2023, Narrative Conceptual Model Overview

Throughout the event, extreme fire danger conditions were reported across regions of Canada, with significant, out of control wildfire activity recorded in Quebec. IDEM's demonstration describes a low-pressure system over the eastern portion of the U.S. with a high pressure settling in over the Hudson Bay. The flow around these two meteorological features allowed transport of Canadian wildfire smoke from Quebec to a wide swath of the eastern U.S., including Terre Haute, IN. The building high-pressure system allowed the smoke to build up in the area causing elevated PM_{2.5} concentrations in Terre Haute. These meteorological features allowed transport and stagnation of Canadian wildfire smoke in Terre Haute, IN. The June 27-29, 2023, HYSPLIT analyses intersected the source regions of the Canadian wildfires which supports the meteorological transport narrative in the demonstration.

Table 8: Narrative Conceptual Model for June 27-29, 2023

Evidence	Demonstration Citation	Summary of the EPA's Review	Criterion Met?
Description of event(s) causing exceedance or violation	Demonstration pp. 173-182	IDEM described wildfire complexes in Quebec and Ontario which caused PM _{2.5} exceedances on June 27-29, 2023.	Y

Evidence	Demonstration Citation	Summary of the EPA's Review	Criterion Met?
Discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s)	Demonstration pp. 173-182	IDEM included meteorological surface and upper air (500 and 850 mb heights) analyses as well as visible satellite imagery depicting wildfire smoke, which aligned with PM _{2.5} concentrations at ground level.	Y
Discusses the interaction of emissions and meteorology	Demonstration pp. 173-182	IDEM included daily average PM _{2.5} concentration plots overlaid with the NOAA's HMS smoke plumes and active fire locations in AirNowTech, surface and upper-level meteorological maps, Canadian Wildland Information System active fire maps, and a meteorological narrative describing how the wildfire emissions from Canada were transported to the Terre Haute area.	Y
Explains regulatory significance	Demonstration pp. 1, 6-18, 321-325	IDEM explained these days are regulatory significant for initial area designations for the 2024 annual PM _{2.5} NAAQS.	Y

July 4, 2023, Narrative Conceptual Model Overview

IDEM's demonstration describes fireworks impacts on July 4, 2023, due to the Fourth of July holiday causing elevated PM_{2.5} concentrations during the evening hours at the Terre Haute - Lafayette Ave monitor. Fireworks were set off in nearby neighborhoods and in Terre Haute's Fairbanks Park (<https://www.terrehaute.in.gov/departments/parks/4th-of-july-celebration-1>) on this day with spikes evident starting at 8:00 pm on July 4, 2023, and lasting through the overnight hours. The hourly data peaked at 142.8 ug/m³ at 10:00 pm for the Terre Haute - Lafayette Ave monitor. As the fireworks associated emissions lingered in the area due to stagnant conditions associated with a surface high pressure, the PM_{2.5} levels remained elevated at the monitor until the early morning hours of July 5, 2023. These meteorological conditions hindered the dispersion of the fireworks emissions until winds picked up slightly the next day when daytime heating and mixing began.

Table 9: Narrative Conceptual Model for July 4, 2023

Evidence	Demonstration Citation	Summary of the EPA’s Review	Criterion Met?
Description of event(s) causing exceedance or violation	Demonstration pp. 219, 230-231	IDEM included information on the Terre Haute main fireworks show which caused PM _{2.5} exceedances on July 4, 2023.	Y
Discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s)	Demonstration pp. 219-221, 228	IDEM included meteorological surface and upper air (500 and 850 mb heights) analyses as well as hourly PM _{2.5} and carbon concentrations.	Y
Discusses the interaction of emissions and meteorology	Demonstration pp. 219-221, 230-231	IDEM included daily average PM _{2.5} concentration plots, surface and upper air (500 and 850 mb heights) meteorological maps, and a meteorological narrative describing how the fireworks emissions affected the Terre Haute – Lafayette Ave monitor.	Y
Explains regulatory significance	Demonstration pp. 1, 6-18, 321-325	IDEM explained these days are regulatory significant for initial area designations for the 2024 annual PM _{2.5} NAAQS.	Y

July 16-18, 2023, Narrative Conceptual Model Overview

Leading up to and throughout the event, active fires continued burning in the British Columbia and Alberta provinces in Canada. IDEM’s demonstration describes a front which brought Canadian wildfire smoke from southwestern Canada to the Terre Haute - Lafayette Ave monitor on July 16, 2023, which stalled just short of Terre Haute through July 18, 2023. This front eventually pushed through Terre Haute on July 18, 2023, which finally cleared out the residual smoke later in the day. Upper air maps also strongly support northwesterly flow from southwestern Canada into the Terre Haute, IN area. These meteorological features allowed transport of Canadian wildfire smoke into the Terre Haute area on July 16-18, 2023. The July 16-18, 2023, HYSPLIT analyses intersected the source regions of the Canadian wildfires which supports the meteorological transport narrative in the demonstration.

Table 10: Narrative Conceptual Model for July 16-18, 2023

Evidence	Demonstration Citation	Summary of the EPA’s Review	Criterion Met?
Description of event(s) causing exceedance or violation	Demonstration pp. 231-238	IDEM described wildfire complexes in British Columbia and Alberta, Canada which caused PM _{2.5} exceedances on July 16-18, 2023.	Y
Discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s)	Demonstration pp. 231-238	IDEM included meteorological surface and upper air (500 and 850 mb heights) analyses as well as visible satellite imagery depicting wildfire smoke, which aligned with PM _{2.5} concentrations at ground level.	Y
Discusses the interaction of emissions and meteorology	Demonstration pp. 231-238	IDEM included daily average PM _{2.5} concentration plots overlaid with the NOAA’s HMS smoke plumes and active fire locations in AirNowTech, surface and upper air (500 and 850 mb heights) meteorological maps, Canadian Wildland Information System active fire maps, and a meteorological narrative describing how the wildfire emissions from Canada were transported to the Terre Haute area.	Y
Explains regulatory significance	Demonstration pp. 1, 6-18, 321-325	IDEM explained these days are regulatory significant for initial area designations for the 2024 annual PM _{2.5} NAAQS.	Y

Clear Causal Relationship and Supporting Analyses

IDEM’s demonstration included the EPA’s Tiering Tool analysis, comparison of event days with historical concentrations, HYSPLIT trajectory analyses (forward and backward), Aerosol Optical Depth and visible satellite imagery, NOAA’s HMS smoke plumes and active fire locations in AirNowTech, General Additive Model, High-Resolution Rapid Refresh-Smoke model, BlueSky smoke model, carbon and PM_{2.5} timeseries, media articles, IDEM air quality forecasts, and NOAA Satellite Smoke Narrative to demonstrate the clear causal relationship between wildfire smoke or fireworks emissions and the

monitor in Terre Haute. Based on the measured PM_{2.5} values, as well as other criteria, all the days described in this TSD, for which the EPA is concurring on, are Tier 1 events.

Comparison with Historical Concentrations

The demonstration includes a comparison with historical concentrations, as required by 40 CFR § 50.14(c)(3)(iv)(C). The demonstration compares the daily average PM_{2.5} concentrations from 2019-2023, while highlighting the wildfire smoke and fireworks emissions on June 14-15, 2022, July 3, 2022, June 5-7, 2023, June 15, 2023, June 17-18, 2023, June 27-29, 2023, July 4, 2023, and July 16-18, 2023, to illustrate the enhancement of PM_{2.5} concentrations on event days compared to monitor concentrations during the rest of the year and previous years. As shown in Figures 1 and 2 below, daily concentrations of exceedance days for the monitor are compared to the Tier 1 cutoff for justification of the demonstration's tier selection.

Figure 1: The EPA's PM_{2.5} Tiering Tool for Exceptional Events Analysis (June)

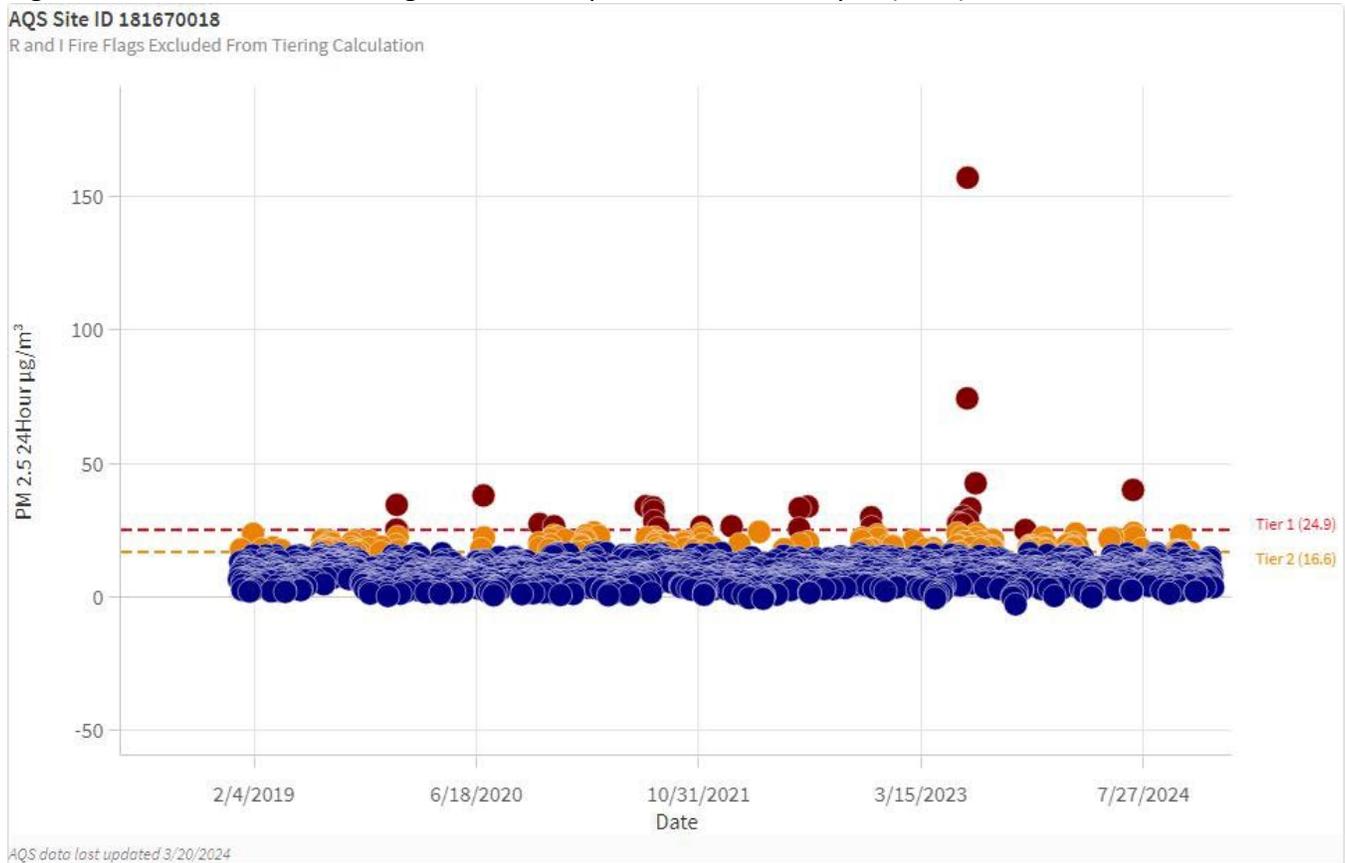


Figure 2: The EPA’s PM_{2.5} Tiering Tool for Exceptional Events Analysis (July)

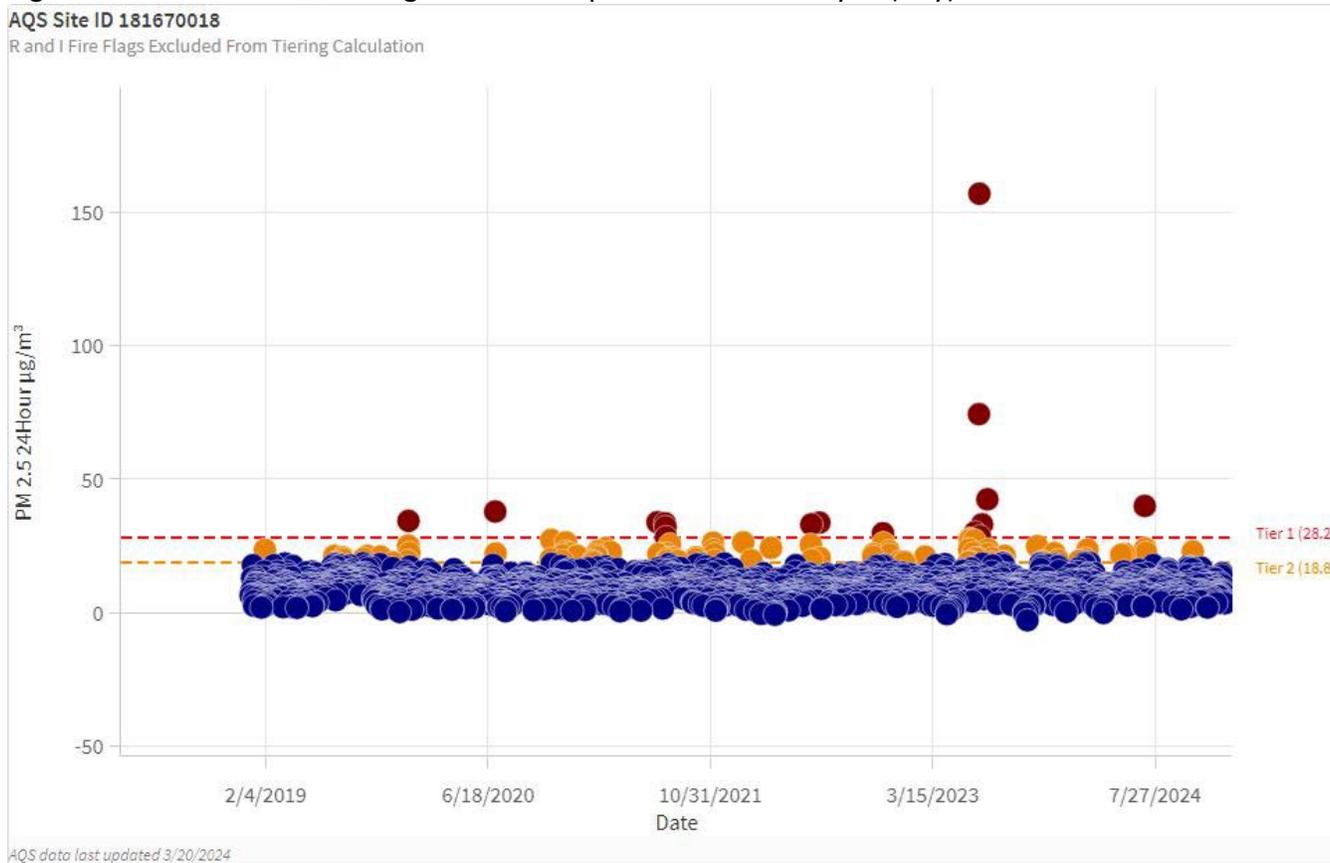


Table 11: Summary of Tiering for Relevant Monitoring Days

Tiering	Demonstration Citation	Tiering Details	Tiers
Tiering for the Terre Haute monitoring site on June 14-15, 2022, July 3, 2022, June 5-7, 2023, June 15, 2023, June 17-18, 2023, June 27-29, 2023, July 4, 2023, and July 16-18, 2023.	Demonstration pp. 8-9	IDEM cited the EPA’s Tiering Tool. Flags excluded from the calculation included R and I Fire Flags. The tiering thresholds were determined by analyzing the full 5-year dataset from 2019-2023.	1

June 14-15, 2022

Evidence of Transport of Wildfire Emissions from the Wildfire to the Monitors

For the exceedances on June 14-15, 2022, IDEM’s demonstration presents evidence of smoke transport from multiple wildfires in the southwestern and southcentral U.S. to the Terre Haute area (see demonstration, pp. 64-72, Figs. 2.2.11-2.2.17). Analyses are supported by forward and backward HYSPLIT trajectories overlaid on PM_{2.5} concentrations, smoke contours, and fire data (see demonstration, pp. 64-67, Figs. 2.2.11-2.2.12), AOD and visible satellite imagery (see demonstration, pp. 67-68, Figs. 2.2.13-2.2.14), HRRR-Smoke vertically integrated model outputs (see demonstration,

pp. 68-70, Fig. 2.2.15), BlueSky Smoke Forecast model outputs (see demonstration, pp. 70-71, Fig. 2.2.16), and GAM analyses (see demonstration, pp. 71-72, Fig. 2.2.17). HYSPLIT trajectories illustrate transport of smoke from the southcentral U.S. (Texas and Arkansas). Smoke is also evident on the satellite imagery.

Evidence that the Wildfire Emissions Affected the Monitors

The PM_{2.5} concentration maps, GAM analyses, and carbon concentration timeseries show the transport of smoke from the southwest and southcentral U.S. wildfires to Terre Haute and depict the smoke impacts at the monitor level from June 14 to June 15, 2022 (see demonstration, pp. 62-64 and 71-75, Figs. 2.2.8-2.2.10 and 2.2.17-2.1.20). Additionally, IDEM included media articles and NOAA Satellite Smoke text products that discussed the wildfire plumes in the southwest and southcentral U.S. (see demonstration, pp. 78-87).

Table 12: Clear Causal Relationship for June 14-15, 2022

Evidence	Demonstration Citation, if applicable	Summary of the EPA’s Review	Criterion Met?
Comparison of Event-Related and Historical Concentrations⁷			
Tiering Tool plots across 5-years (2019-2023) and daily average PM _{2.5} concentration plots	Demonstration pp. 8-12, 56-57	PM _{2.5} concentrations on June 14-15, 2022, exceeded 1.5 times the Tiering Threshold, confirming Tier 1 and distinct elevated concentrations.	Y
Evidence that the Fire Emissions were Transported to the Monitor(s)⁸			
HYSPLIT Trajectories and Satellite Imagery (AOD, visible, HMS smoke plumes, and detections of active fires in Canada), the HRRR-Smoke model, and the BlueSky model	Demonstration pp. 64-71	HYSPLIT trajectories (backward and forward), satellite imagery, HRRR-Smoke model outputs, and BlueSky model outputs demonstrated smoke transport from across the U.S. to Terre Haute on June 14-15, 2022.	Y

⁷The EPA’s Guidance Prescribed Fire on Wildland that May Influence Ozone and Particulate Matter Concentrations (Prescribed Fire Guidance) offers examples of analyses that may be used to satisfy the comparison to historical concentrations criterion for wildland fires that may have influenced PM concentrations, including: Comparison of concentration on the claimed event day(s) with a set of similar days, a percentile of event-related concentration(s) relative to annual and/or seasonal data; 99th percentile over 5 years or fourth highest within one year; Description of past high data points labeled as being associated with previous exceptional events, suspected exceptional events, other unusual occurrences, or high pollution days due to normal emissions, with basic evidence to support claims and recognition that a history of concentrations above the standard could indicate additional evidence needed; Indication of how typically observed non-event diurnal or seasonal pattern differs, if such a deviation occurred, due to the event, with more weight given to effective statistical summaries that characterize non-event, high-concentration day historical data and the differences seen on event days over anecdotal or general assertions.

⁸The EPA’s Prescribed Fire Guidance offers examples of analyses that may be used to show emissions transport from wildland fires that may have influenced PM concentrations, including: Atmospheric trajectory analysis/modeling; Satellite imagery of plume with evidence of plume impacting the ground; Satellite imagery of plume with evidence of plume impacting the ground; Provision of additional information, such as analyses of relevant meteorological conditions (e.g., wind speed and direction at the height of the smoke plume) further supporting the clear causal relationship rule element.

Evidence	Demonstration Citation, if applicable	Summary of the EPA's Review	Criterion Met?
Evidence that the Fire Emissions Affected the Monitor(s)⁹			
PM _{2.5} surface concentrations, GAM analyses, carbon concentration timeseries, media articles, and NOAA smoke narratives	Demonstration pp. 62-64, 71-75, 78-87	Spatial distribution of PM _{2.5} across the Midwest demonstrates regional impacts of wildfire smoke at the ground level on June 14-15, 2022. Additionally, IDEM's GAM analyses, carbon concentration timeseries, media articles, and NOAA smoke narratives show the wildfire smoke plume impacts at the surface.	Y
Concluding Statement			
Inclusion of a concluding statement that explains how the demonstration meets the relevant statutory and regulatory criteria	Demonstration pp. 87-89, 323-325	IDEM's demonstration summarizes how the demonstration meets the requirements in the Exceptional Event Rule and meets the clear causal criteria.	Y

July 3, 2022

For the exceedances on July 3, 2022, IDEM's demonstration presents evidence of fireworks impacts on July 3, 2022, due to neighborhood and the city of Terre Haute fireworks emissions. Two fireworks shows in the city of Terre Haute (at the Sycamore Winery and the Bridge Church) took place on the same day as the recorded exceedance at the Terre Haute – Lafayette Ave monitor (<https://www.mywabashvalley.com/community/where-to-watch-fireworks-around-the-wabash-valley/>.) The fireworks impacts are supported by hourly PM_{2.5} and carbon timeseries showing a clear spike in concentrations from 8:00 PM – 11:00 PM on July 3, 2022 (see demonstration, pp. 89-91, 94, and 96-97).

⁹ The EPA's Prescribed Fire Guidance offers examples of analyses that may be used to show impacts from emissions of wildland fires at the monitor, including: Plots of elevated fire-related species near the monitor (e.g., PM, carbon monoxide); Elevated light extinction measurements at or near the monitoring site; Photographic evidence of ground-level smoke at the monitor; The timing and spatial distribution of fire-related pollutants shown with data from multiple monitoring sites; Differences in carbon monoxide: nitrogen oxides ratios, and/or; PM speciation data that indicate fire impacts; Inclusion of matching day analyses, statistical regression models, or photochemical models, as needed.

Table 13: Clear Causal Relationship for July 3, 2022

Evidence	Demonstration Citation, if applicable	Summary of the EPA's Review	Criterion Met?
Comparison of Event-Related and Historical Concentrations			
Tiering Tool plots across 5-years (2019-2023) and daily average PM _{2.5} concentration plots	Demonstration pp. 6 - 12, 90, 93	PM _{2.5} concentrations on July 3, 2022, exceeded 1.5 times the Tiering Threshold, confirming Tier 1 and distinct elevated concentrations.	Y
Evidence that the Fireworks Emissions were Transported to and Affected the Monitor(s)			
PM _{2.5} and carbon concentration timeseries, and media articles	Demonstration pp. 89-91, 94, 96-97	The city of Terre Haute fireworks show timing aligns with the spike of PM _{2.5} and carbon concentrations on July 3, 2022.	Y
Concluding Statement			
Inclusion of a concluding statement that explains how the demonstration meets the relevant statutory and regulatory criteria	Demonstration pp. 96-97, 321	IDEM's demonstration summarizes how the demonstration meets the requirements in the Exceptional Event Rule and meets the clear causal criteria.	Y

June 5-7, 2023

Evidence of Transport of Wildfire Emissions from the Wildfire to the Monitors

For the exceedances on June 5-7, 2023, IDEM's demonstration presents evidence of smoke transport from Quebec and southeastern Canadian wildfires to the Terre Haute area (see demonstration, pp. 112-123, Figs. 2.4.12-2.4.22). Analyses are supported by forward and backward HYSPLIT trajectories overlaid on PM_{2.5} concentrations, smoke contours, and the fire data (see demonstration, pp. 114-118, Figs. 2.4.15-2.4.17), AOD and visible satellite imagery (see demonstration, pp. 118-120, Figs. 2.4.18-2.4.20), HRRR-Smoke model analyses (see demonstration, pp. 120-121, Fig. 2.4.21), and GAM analyses (see demonstration, pp. 122-123, Fig. 2.4.22). HYSPLIT trajectories provided in IDEM's demonstration illustrate transport of smoke from southeastern Canada to the Terre Haute area on June 5-7, 2023. Smoke is also evident on the visible satellite imagery.

Evidence that the Wildfire Emissions Affected the Monitors

The PM_{2.5} concentration maps, GAM analyses, and carbon concentration timeseries show the transport of the smoke from Canadian wildfires to Terre Haute and depict the smoke impacts at the monitor level on June 5-7, 2023 (see demonstration, pp. 112-114 and 122-127, Figs. 2.4.12-2.4.14 and 2.4.22-2.4.24). Additionally, IDEM included media articles, NOAA Satellite Smoke text products, and IDEM air quality

forecasts discussing the wildfire plume impacts in the eastern U.S. as well as Terre Haute (see demonstration, pp. 129-133).

Table 14: Clear Causal Relationship for June 5-7, 2023

Evidence	Demonstration Citation, if applicable	Summary of the EPA’s Review	Criterion Met?
Comparison of Event-Related and Historical Concentrations			
Tiering Tool plots across 5-years (2019-2023) and daily average PM _{2.5} concentration plots	Demonstration pp. 2-9, 98	PM _{2.5} concentrations on June 5-7, 2023, exceeded 1.5 times the Tiering Threshold, confirming Tier 1 and distinct elevated concentrations.	Y
Evidence that the Fire Emissions were Transported to the Monitor(s)			
HYSPLIT Trajectories, Satellite Imagery (AOD, visible, HMS smoke plumes, and detections of active fires in Canada), and the HRRR-Smoke model	Demonstration pp. 114-121	HYSPLIT trajectories (backward and forward), satellite imagery, and HRRR-Smoke model outputs (vertically integrated and near-surface) demonstrated smoke transport from Quebec and southeastern Canada to Terre Haute on June 5-7, 2023.	Y
Evidence that the Fire Emissions Affected the Monitor(s)			
PM _{2.5} surface concentrations, GAM analyses, carbon concentration timeseries, media articles, NOAA smoke narratives, and IDEM air quality forecasts	Demonstration pp. 112-114, 122-127, 129-133	Spatial distribution of PM _{2.5} across the Midwest demonstrates regional impacts of wildfire smoke at the ground level on June 5-7, 2023. Additionally, IDEM’s GAM analyses, carbon concentration timeseries, media articles, NOAA smoke narratives, and IDEM air quality forecasts show the wildfire smoke plume impacts at the surface.	Y

Evidence	Demonstration Citation, if applicable	Summary of the EPA's Review	Criterion Met?
Concluding Statement			
Inclusion of a concluding statement that explains how the demonstration meets the relevant statutory and regulatory criteria	Demonstration pp. 133-135	IDEM's demonstration summarizes how the demonstration meets the requirements in the Exceptional Event Rule and meets the clear causal criteria.	Y

June 15, 2023, and June 17-18, 2023

Evidence of Transport of Wildfire Emissions from the Wildfire to the Monitors

For the exceedances on June 15, 2023, and June 17 -18, 2023, IDEM's demonstration presents evidence of smoke transport from the Quebec and Ontario wildfires to the Terre Haute area (see demonstration, pp. 145-153, Figs. 2.5.13-2.5.20). Analyses are supported by forward and backward HYSPLIT trajectories overlaid on PM_{2.5} concentrations, smoke contours, and fire data (see demonstration, pp. 145-148, Figs. 2.5.13-2.5.15), AOD and visible satellite imagery (see demonstration, pp. 148-150, Figs. 2.5.16-2.5.18), HRRR-Smoke model analyses (see demonstration, pp. 150-152, Fig. 2.5.19), and GAM analyses (see demonstration, pp. 152-153, Fig. 2.5.20). HYSPLIT trajectories from IDEM's demonstration as well as visible satellite imagery illustrate transport of smoke from eastern Canada (Quebec and Ontario) to the Terre Haute area on June 15, 2023, and June 17-18, 2023.

Evidence that the Wildfire Emissions Affected the Monitors

The PM_{2.5} concentration maps, GAM analyses, and carbon concentration timeseries show the transport of the smoke from Canadian wildfires to Terre Haute and depict the smoke impacts at the monitor level on June 15, 2023, and June 17-18, 2023 (see demonstration, pp. 143-145 and 152-161, Figs. 2.5.10-2.5.12 and 2.5.20-2.5.22). Additionally, IDEM included media articles, NOAA Satellite Smoke Text Products, and IDEM air quality forecasts and discussions that discussed the wildfire plume impacts in the U.S. as well as Terre Haute (see demonstration, pp. 162-171).

Table 15: Clear Causal Relationship for June 15, 2023, and June 17-18, 2023

Evidence	Demonstration Citation, if applicable	Summary of the EPA's Review	Criterion Met?
Comparison of Event-Related and Historical Concentrations			
Tiering Tool plots across 5-years (2019-2023) and daily average PM _{2.5} concentration plots	Demonstration pp. 2-9, 135-136	PM _{2.5} concentrations on June 15, 2023, and June 17-18, 2023, exceeded 1.5 times the Tiering Threshold, confirming Tier 1 and distinct elevated concentrations.	Y

Evidence	Demonstration Citation, if applicable	Summary of the EPA's Review	Criterion Met?
Evidence that the Fire Emissions were Transported to the Monitor(s)			
HYSPLIT Trajectories, Satellite Imagery (AOD, visible, HMS smoke plumes, and detections of active fires in Canada), and the HRRR-Smoke model	Demonstration pp 145-152	HYSPLIT trajectories (backward and forward), satellite imagery, and HRRR-Smoke model outputs (vertically integrated and near-surface) demonstrated smoke transport from Quebec and southeastern Canada to Terre Haute on June 15, 2023, and June 17-18, 2023.	Y
Evidence that the Fire Emissions Affected the Monitor(s)			
PM _{2.5} surface concentrations, GAM analyses, carbon concentration timeseries, media articles, NOAA smoke narratives, and IDEM air quality forecasts	Demonstration pp. 143-145, 152-171	Spatial distribution of PM _{2.5} across the Midwest demonstrates regional impacts of wildfire smoke at the ground level on June 15, 2023, and June 17-18, 2023. Additionally, IDEM's GAM analyses, carbon concentration timeseries, media articles, NOAA smoke narratives, and IDEM air quality forecasts show the wildfire smoke plume impacts at the surface.	Y
Concluding Statement			
Inclusion of a concluding statement that explains how the demonstration meets the relevant statutory and regulatory criteria	Demonstration pp. 172-173	IDEM's demonstration summarizes how the demonstration meets the requirements in the Exceptional Event Rule and meets the clear causal criteria.	Y

June 27-29, 2023

Evidence of Transport of Wildfire Emissions from the Wildfire to the Monitors

For the exceedances on June 27-29, 2023, IDEM's demonstration presents evidence of smoke transport from Quebec wildfires to the Terre Haute area (see demonstration, pp. 185-192, Figs. 2.6.11-2.6.18). Analyses are supported by forward and backward HYSPLIT trajectories overlaid on PM_{2.5}

concentrations, smoke contours, and fire data (see demonstration, pp. 184-187, Figs. 2.6.11-2.6.13), AOD and visible satellite imagery (see demonstration, pp. 188-189, Figs. 2.6.14-2.6.16), HRRR-Smoke analyses (see demonstration, pp. 189-191, Fig. 2.6.17), and GAM analyses (see demonstration, pp. 191-192, Fig. 2.6.18). HYSPLIT trajectories illustrate transport of smoke from eastern Canada to the Terre Haute area on June 27-29, 2023. Smoke is also evident on the satellite imagery.

Evidence that the Wildfire Emissions Affected the Monitors

The PM_{2.5} concentration maps, GAM analyses, and carbon concentration timeseries show the transport of the smoke from Canadian wildfires to Terre Haute and depict the smoke impacts at the monitor level leading up to and on June 27-29, 2023 (see demonstration, pp. 182-197, Figs. 2.6.8-2.6.10, 2.6.18-2.6.20). Additionally, IDEM included media articles, NOAA smoke narratives, and IDEM air quality forecasts discussing the wildfire plume impacts in the eastern U.S. as well as Terre Haute (see demonstration, pp. 199-217).

Table 16: Clear Causal Relationship for June 27-29, 2023

Evidence	Demonstration Citation, if applicable	Summary of the EPA’s Review	Criterion Met?
Comparison of Event-Related and Historical Concentrations			
Tiering Tool plots across 5-years (2019-2023) and daily average PM _{2.5} concentration plots	Demonstration pp. 6-12, 174, 193	PM _{2.5} concentrations on June 27-29, 2023, exceeded 1.5 times the Tiering Threshold, confirming Tier 1 and distinct elevated concentrations.	Y
Evidence that the Fire Emissions were Transported to the Monitor(s)			
HYSPLIT Trajectories, Satellite Imagery (AOD, visible, HMS smoke plumes, and detections of active fires in Canada), and the HRRR-smoke model	Demonstration pp. 182-191	HYSPLIT trajectories (backward and forward), satellite imagery, and the HRRR-Smoke model demonstrated smoke transport from Quebec to Terre Haute on June 27-29, 2023.	Y

Evidence	Demonstration Citation, if applicable	Summary of the EPA's Review	Criterion Met?
Evidence that the Fire Emissions Affected the Monitor(s)			
PM _{2.5} surface concentrations, GAM analyses, carbon concentration timeseries, media articles, NOAA smoke narratives, and IDEM air quality forecasts	Demonstration pp. 191-217	Spatial distribution of PM _{2.5} across the Midwest demonstrates regional impacts of wildfire smoke at the ground level on June 27-29, 2023. Additionally, IDEM's GAM analyses, carbon concentration timeseries, media articles, NOAA smoke narratives, and IDEM air quality forecasts show the wildfire smoke plume impacts at the surface.	Y
Concluding Statement			
Inclusion of a concluding statement that explains how the demonstration meets the relevant statutory and regulatory criteria	Demonstration pp. 217-219	IDEM's demonstration summarizes how the demonstration meets the requirements in the Exceptional Event Rule and meets the clear causal criteria.	Y

July 4, 2023

For the exceedances on July 4, 2023, IDEM's demonstration presents evidence of fireworks impacts on July 4, 2023, due to neighborhood and the city of Terre Haute fireworks emissions. The city of Terre Haute fireworks show took place on the same day as the recorded exceedance at the Terre Haute – Lafayette Ave monitor. The fireworks impacts are supported by hourly PM_{2.5} and carbon timeseries showing a clear spike in concentrations at 8:00 pm on July 4, 2023, and lasting throughout the overnight hours as meteorological conditions were stagnant (see demonstration, pp. 219-221, 228, 230-231).

Table 17: Clear Causal Relationship for July 4, 2023

Evidence	Demonstration Citation, if applicable	Summary of the EPA's Review	Criterion Met?
Comparison of Event-Related and Historical Concentrations			
Tiering Tool plots across 5-years (2019-2023) and daily average PM _{2.5} concentration plots	Demonstration pp. 6-12, 220, 227	PM _{2.5} concentrations on July 4, 2023, exceeded 1.5 times the Tiering Threshold, confirming Tier 1 and distinct elevated concentrations.	Y

Evidence	Demonstration Citation, if applicable	Summary of the EPA's Review	Criterion Met?
Evidence that the Fireworks Emissions were Transported to and Affected the Monitor(s)			
PM _{2.5} and carbon concentration timeseries, media articles	Demonstration pp. 219-221, 228, 230-231	The city of Terre Haute fireworks show timing aligns with the spike of PM _{2.5} and carbon concentrations on July 4, 2023.	Y
Concluding Statement			
Inclusion of a concluding statement that explains how the demonstration meets the relevant statutory and regulatory criteria	Demonstration p. 230-231, 321	IDEM's demonstration summarizes how the demonstration meets the requirements in the Exceptional Event Rule and meets the clear causal criteria.	Y

July 16-18, 2023

Evidence of Transport of Wildfire Emissions from the Wildfire to the Monitors

For the exceedances on July 16-18, 2023, IDEM's demonstration presents evidence of smoke transport from British Columbia and Alberta wildfires to the Terre Haute area (see demonstration, pp. 240-248, Figs. 2.8.11-2.8.18). Analyses are supported by forward and backward HYSPLIT trajectories overlaid on PM_{2.5} concentrations, smoke contours, and fire data (see demonstration, pp. 241-243, Figs. 2.8.11-2.8.13), AOD and visible satellite imagery (see demonstration, pp. 244-245, Figs. 2.8.14-2.8.16), HRRR-Smoke analyses (see demonstration, pp. 246-247, Fig. 2.8.17), and GAM analyses (see demonstration, p. 248, Fig. 2.8.18). HYSPLIT trajectories illustrate transport of smoke from eastern Canada to the Terre Haute area on July 16-18, 2023. Smoke is also evident on the satellite imagery.

Evidence that the Wildfire Emissions Affected the Monitors

The PM_{2.5} concentration maps, GAM analyses, and carbon concentration timeseries show the transport of the smoke from Canadian wildfires to Terre Haute and depict the smoke impacts at the monitor level on July 16-18, 2023 (see demonstration, pp. 239-253, Figs. 2.8.8-2.8.10, 2.8.18-2.8.20). Additionally, IDEM included media articles, NOAA smoke narratives, and IDEM air quality forecasts discussing the wildfire plume impacts in the eastern U.S. as well as Terre Haute (see demonstration, pp. 254-264).

Table 18: Clear Causal Relationship for July 16-18, 2023

Evidence	Demonstration Citation, if applicable	Summary of the EPA's Review	Criterion Met?
Comparison of Event-Related and Historical Concentrations			
Tiering Tool plots across 5-years (2019-2023) and daily average PM _{2.5} concentration plots	Demonstration pp. 6-12, 232, 249	PM _{2.5} concentrations on July 16-18, 2023, exceeded 1.5 times the Tiering Threshold, confirming Tier 1 and distinct elevated concentrations.	Y
Evidence that the Fire Emissions were Transported to the Monitor(s)			
HYSPLIT Trajectories, Satellite Imagery (AOD, visible, HMS smoke plumes, and detections of active fires in Canada), and the HRRR-smoke model	Demonstration pp. 241-247	HYSPLIT trajectories (backward and forward), satellite imagery, and the HRRR-Smoke model demonstrated smoke transport from Canada to Terre Haute on July 16-18, 2023.	Y
Evidence that the Fire Emissions Affected the Monitor(s)			
PM _{2.5} surface concentrations, GAM analyses, carbon concentration timeseries, media articles, NOAA smoke narratives, and IDEM air quality forecasts	Demonstration pp. 248-264	Spatial distribution of PM _{2.5} across the Midwest demonstrates regional impacts of wildfire smoke at the ground level on July 16-18, 2023. Additionally, IDEM's GAM analyses, carbon concentration timeseries, media articles, NOAA smoke narratives, and IDEM air quality forecasts show the wildfire smoke plume impacts at the surface.	Y
Concluding Statement			
Inclusion of a concluding statement that explains how the demonstration meets the relevant statutory and regulatory criteria	Demonstration pp. 264-266, 321	IDEM's demonstration summarizes how the demonstration meets the requirements in the Exceptional Event Rule and meets the clear causal criteria.	Y

Not Reasonably Controllable or Preventable

The EER presumes that wildfire events on wildland are not reasonably controllable or preventable per 40 CFR § 50.14(b)(4). IDEM's demonstration provided evidence that the wildfire events meet the definition of wildfire. As the wildfires in the U.S. and Canada were reported to have been started by unplanned ignitions caused by lightning or prescribed fires that became out of control, they are

considered wildfires. Additionally, IDEM demonstrated how fireworks emissions were caused by July Fourth celebrations which is a cultural event as described in 40 CFR § 50.14(b)(2). Therefore, the documentation sufficiently demonstrates that the event was not reasonably controllable and not reasonably preventable.

Table 19: Not Reasonably Controllable or Preventable for the U.S. and Canadian Wildfires

Evidence	Demonstration Citation, if applicable	Summary of the EPA’s Review	Criterion Met?
Does the event meet the EER definition of a wildfire?	Demonstration pp. 76-77, 128, 162-166, 198-206, 254-255, Appendix A	The wildfires were caused by natural factors such as lightning, or unexpected weather conditions affecting a preapproved prescribed burn.	Y
Did the wildfire occur predominately on wildland as defined in the EER?	Demonstration pp. 76-77, 128, 162-166, 198-206, 254-255, Appendix A	Wildfires occurred in undeveloped areas across the U.S. and Canada, meeting the definition of wildland.	Y
Concluding Statement			
Inclusion of a concluding statement that explains how the demonstration meets the relevant statutory and regulatory criteria	Demonstration pp. 76-77, 128, 162-166, 198-206, 254-255, Appendix A	IDEM summarizes how the wildfire events were on wildland and not reasonably controllable or preventable.	Y

The EER states that fireworks displays that are significantly integral to traditional events, including the Fourth of July, shall be treated in the same manner as exceptional events [40 CFR § 50.14(b)(2)]. IDEM’s demonstration provided evidence that the exceedances recorded on July 3, 2022, and July 4, 2023, were the result of Fourth of July fireworks displays. Therefore, this sufficiently demonstrates that the event should be treated as not reasonably controllable or preventable.

Table 20: Not Reasonably Controllable or Preventable for Fireworks

Evidence	Demonstration Citation, if applicable	Summary of the EPA’s Review	Criterion Met?
Does the event satisfy the EER requirements in 40 CFR § 50.14(b)(2) for fireworks displays?	Demonstration pp. 95, 229-230	The fireworks emissions were caused by July Fourth celebrations, which is a cultural event.	Y

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.” IDEM’s demonstration includes documentation that the event meets the definition

of a wildfire and occurred predominantly on wildland, including satellite imagery, land-use maps, graphical data, media, and news reporting, demonstrating that the fires were unplanned and occurred in areas with little human activity or development. Additionally, IDEM demonstrated how fireworks emissions were caused by July Fourth celebrations which is a cultural event as described in 40 CFR § 50.14(b)(2). IDEM has therefore shown that these events meet the EER criteria.

Table 21: Natural Event or Human Activity Unlikely to Recur at a Particular Location for Wildfires

Evidence	Demonstration Citation	Summary of the EPA’s Review	Criterion Met?
Does the event meet the EER definition of a wildfire?	Demonstration pp. 77-78, 128-129, 166, 207, 255-256, Appendix A	The wildfires were unplanned ignitions caused by natural factors, as defined in the EER, or resulting from unexpected weather conditions affecting a preapproved prescribed burn. These fires that impacted the monitor also occurred on wildland.	Y
Concluding Statement			
Inclusion of a concluding statement that explains how the demonstration meets the relevant statutory and regulatory criteria	Demonstration pp. 77-78, 128-129, 166, 207, 255-256, Appendix A	IDEM’s evidence demonstrated the fires were natural events occurring predominantly on wildland.	Y

The EER states that fireworks displays that are significantly integral to traditional events, including the Fourth of July, shall be treated in the same manner as exceptional events [40 CFR § 50.14(b)(2)]. IDEM’s demonstration provided evidence that the exceedances recorded on July 3, 2022, and July 4, 2023, were the result of Fourth of July fireworks displays. IDEM’s demonstration includes documentation that the event meets the requirements of fireworks displays and is therefore an exceptional event.

Table 22: Natural Event or Human Activity Unlikely to Recur at a Particular Location for Fireworks

Evidence	Demonstration Citation	Summary of the EPA’s Review	Criterion Met?
Does the event satisfy the EER requirements in 40 CFR § 50.14(b)(2) for fireworks displays?	Demonstration pp. 96, 230	The fireworks emissions were caused by July Fourth celebrations, which is a cultural event.	Y

CONCLUSION

The EPA has reviewed the documentation provided by IDEM to support claims that fireworks emissions and smoke from wildfires in the U.S. and Canada caused exceedances of the 2024 annual PM_{2.5} standard at the Terre Haute – Lafayette Avenue monitoring site on June 14-15, 2022, July 3, 2022, June 5-7, 2023, June 15, 2023, June 17-18, 2023, June 27-29, 2023, July 4, 2023, and July 16-18, 2023. The

EPA has determined that the flagged exceedances at these monitoring sites on these days satisfy the exceptional events 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. The EPA has also determined that the IDEM has satisfied the procedural requirements for data exclusion from comparison to the NAAQS.

TECHNICAL SUPPORT DOCUMENT FOR THE EPA'S CONCURRENCE ON PM_{2.5} EXCEEDANCES MEASURED IN SOUTH BEND, IN ON JUNE 18, 2023, JUNE 27-30, 2023, JULY 16, 2023, AND JULY 25, 2023, AS EXCEPTIONAL EVENTS

On January 22, 2025, the U.S. Environmental Protection Agency received the Indiana Department of Environmental Management's exceptional event demonstration, dated January 16, 2025. IDEM's exceptional event demonstration addresses exceedances of the 2024 annual particulate matter with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers National Ambient Air Quality Standards that occurred at the South Bend-Shields Dr (Air Quality System ID: 18-141-0015) monitoring site in St. Joseph County, IN on June 18, 2023, June 27-30, 2023, July 16, 2023, and July 25, 2023. The demonstration submitted by IDEM states that the exceedances measured on June 18, 2023, June 27-30, 2023, July 16, 2023, and July 25, 2023, were caused by smoke entering the region from multiple wildfires in Canada. Under the Exceptional Events Rule, air agencies can request the exclusion of event-influenced data, and the EPA can concur to exclude these data, from the data set used for certain regulatory decisions. The remainder of this document summarizes the EER requirements, the subject events and the EPA's review of IDEM's submitted exceptional events demonstration.

EXCEPTIONAL EVENTS RULE REQUIREMENTS

The EPA promulgated the current EER in 2016, pursuant to Clean Air Act § 319. The EER added § 50.1(j)-(r), 50.14, and 51.930 to Title 40 of the Code of Federal Regulations. These sections contain definitions, criteria for the EPA's approval, procedural requirements, and requirements for air agency demonstrations. The 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 the EER criteria for the EPA to concur with excluding the air quality data from regulatory decisions. If the demonstration is found to not have regulatory significance, the EPA may defer making a concurrence determination.

Under 40 CFR § 50.14(c)(3)(iv), the air agency's 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 ("initial notification") and flagging of the affected data in the EPA's 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. We include below a summary of the EER criteria, including those identified in 40 CFR § 50.14(c)(3)(iv).

Regulatory Significance

The EER includes regulatory language that applies the provisions of CAA § 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 inadequacy leading to a SIP call; and other actions on a case-by-case basis as determined by the Administrator. Air agencies and the 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 the EPA's review.

Narrative Conceptual Model

The EER 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. Further, under 40 CFR § 50.14(a)(1)(i), the narrative conceptual model must describe the regulatory significance of the proposed data exclusion. For wildfire events, the EPA recommends that the narrative conceptual model also discuss emissions, meteorology, and pollutant transport. Air agencies may support the narrative conceptual model with summary tables or maps.

Clear Causal Relationship and Supporting Analyses

The EPA considers a variety of evidence when evaluating whether there is a clear causal relationship between a specific event and the monitored exceedance or violation. For wildfire PM_{2.5} events, air agencies should compare the PM_{2.5} data requested for exclusion with 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 PM_{2.5} exceedance or violation.

For wildfire PM_{2.5} events, the EPA has published the *PM_{2.5} Wildland Fire Exceptional Events Tiering Document* which provides three 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 the clear causal relationship for some wildfire events may be more explicit and/or extreme and, under the weight of evidence approach, may require relatively less evidence to satisfy the rule requirements.

² See the EPA's PM_{2.5} *Wildland Fire Exceptional Events Tiering Document*, April 2024 (the EPA's PM_{2.5} Tiering Document).

To determine the tier for an event, the air agency will first determine the tiering threshold for the monitor day. The tiering thresholds are based on the lesser value of either (a) the most recent 5-year month specific 98th percentile for 24-hour PM_{2.5} data, or (b) the minimum annual 98th percentile for 24-hour PM_{2.5} data for the most recent 5-year period. In calculating both (a) and (b), all data with any “Request Exclusion” (R) or fire-related “Informational Only” (I) qualifiers are excluded when using the *PM_{2.5} Tiering Tool* available on the EPA’s website. Air agencies are encouraged to evaluate their data carefully and consult with their EPA regional office about any data anomalies on a case-by-case basis. The EPA also retains its authority and discretion to evaluate data anomalies in submitted data and determine what tier is applicable for a candidate event.

- Tier 1:
 - **Key Factor for Tier 1 Analyses:** Distinct high levels of monitored 24-hour PM_{2.5} concentrations when compared to historical monthly or annual 24-hour levels of PM_{2.5}.
 - **Criteria:** Event-related exceedances should be greater than or equal to 1.5 times the tiering threshold as described for that candidate event day to be clearly distinguishable from non-event related concentrations.
 - In addition to the supporting analysis used to determine the Tier 1 criteria are met, the air agency should also supply at least one piece of additional evidence to support that the emissions from the fire were transported to the monitor location.
- Tier 2:
 - **Key Factor for Tier 2 Analyses:** High levels of monitored 24-hour PM_{2.5} concentrations, when compared to historical monthly or annual 24-hour levels of PM_{2.5}.
 - **Criteria:** Event-related exceedances are greater than or equal to the tiering threshold but less than 1.5 times the tiering threshold.
 - In addition to the evidence required for a Tier 1 analysis, the air agency should supply at least two additional pieces of evidence, one of which must be quantitative, to support a weight of evidence conclusion that it was the emissions from the wildfire, rather than other sources, that affected the monitored PM_{2.5} concentration.
- Tier 3:
 - **Key Factor for Tier 3 Analyses:** The relationship between the wildfire and the PM_{2.5} exceedance/violation is more complicated than the relationship in a Tier 2 analysis and thus would require more supporting documentation.
 - **Criteria:** Tier 3 demonstrations are appropriate when the measured 24-hour PM_{2.5} concentration is less than the tiering threshold and there are not any other extenuating circumstances or data anomalies that would point to a Tier 2 analysis being sufficient.
 - 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 PM_{2.5} exceedance.

Not Reasonably Controllable or Preventable

The EER 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 EER, an exceptional event must be “an event caused by human activity that is unlikely to recur at a particular location or a natural event.” The EER 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 would be needed 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.

THE EPA’S REVIEW OF EXCEPTIONAL EVENTS DEMONSTRATION

On November 1, 2024, IDEM submitted an Initial Notification of Potential Exceptional Events and on January 22, 2025, IDEM submitted an exceptional events demonstration, dated January 16, 2025. The demonstration is for seven exceedances of the 2024 annual PM_{2.5} NAAQS that occurred at the South Bend-Shields Dr (AQS ID: 18-141-0015) monitoring site on June 18, 2023, June 27-30, 2023, July 16, 2023, and July 25, 2023, located within the South Bend Core Based Statistical Area, St. Joseph County, IN.⁴

Regulatory Significance

The EPA determined that exclusion of these exceedances of the PM_{2.5} standard have regulatory significance for initial area designations of the South Bend CBSA for the 2024 annual PM_{2.5} NAAQS and worked with IDEM to identify the relevant exceedances, monitoring sites affected, and tiers. Table 1 summarizes these exceedances.

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 See Indiana-PM_{2.5} Exceptional Events Initial Notification-South Bend

Table 1: Summary of Data Requested for Exclusion⁵

Exceedance Date	Monitoring Site Name	AQS ID	Monitored Concentration (µg/m ³)	Tier
June 18, 2023	South Bend-Shields Dr	18-141-0015	35.7	1
June 27, 2023	South Bend-Shields Dr	18-141-0015	145.4	1
June 28, 2023	South Bend-Shields Dr	18-141-0015	114.1	1
June 29, 2023	South Bend-Shields Dr	18-141-0015	52.2	1
June 30, 2023	South Bend-Shields Dr	18-141-0015	31.3	1
July 16, 2023	South Bend-Shields Dr	18-141-0015	39.6	1
July 25, 2023	South Bend-Shields Dr	18-141-0015	52.9	1

Concurrence on the exceedances listed in Table 1 would result in changing the design value for South Bend-Shields Dr from 9.4 µg/m³ to 9.0 µg/m³. The design value reductions for the site with three years of available data would result in the South Bend CBSA attaining the 2024 annual PM_{2.5} standard. Table 2 summarizes the effect of this exceptional events demonstration on the monitor’s design value.

Table 2: Summary of Regulatory Significance

Monitoring Site	Affected Regulatory Action	21-23 Design Value without the EPA’s Concurrence (µg/m ³)	21-23 Design Value with the EPA’s Concurrence (µg/m ³)	22-24 Design Value without the EPA’s Concurrence (µg/m ³)	22-24 Design Value with the EPA’s Concurrence (µg/m ³)
South Bend-Shields Dr	Initial area designations determinations for the 2024 annual PM _{2.5} NAAQS	9.4	9.0	8.7	8.4

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 3 outlines the EPA’s evaluation of these requirements.

⁵ See AQS Report AMP355, Report Request ID: 2282781, dated April 15, 2025.

Table 3: Procedural Criteria

Evidence	Demonstration Citation, if applicable	Summary of the EPA’s Review	Criterion Met?
Did the agency appropriately flag the affected data in the EPA's Air Quality System?	Indiana-PM _{2.5} Exceptional Events Initial Notification-South Bend	The EPA verified that IDEM applied request exclusion qualifiers to all PM _{2.5} monitors for June 18, 2023, June 27-30, 2023, July 16, 2023, and July 25, 2023, at the South Bend-Shields Dr site.	Y
Did the agency submit an Initial Notification?	Indiana-PM _{2.5} Exceptional Events Initial Notification-South Bend	IDEM submitted the Initial Notification via email to the EPA on November 1, 2024.	Y
Did the initial notification and demonstration submittals meet the deadlines for data influenced by exceptional events for use in initial area designations?	Demonstration p. 1; Indiana-PM _{2.5} Exceptional Events Initial Notification-South Bend	IDEM submitted the Initial Notification to the EPA on November 1, 2024, and the final demonstration to the EPA on January 22, 2025.	Y
Was the 30-day public comment process followed and documented?	Demonstration p. 139; Demonstration Attachment A	IDEM solicited, reviewed, and documented public comments per 40 CFR § 50.14(c)(3)(v). The comment period was open from November 18, 2024, to December 18, 2024.	Y
Did the agency submit to the EPA, and address in their demonstration, any public comments received?	Demonstration p. 139; Demonstration Attachment A	No public commentary was received.	Y

Mitigation Requirements

IDEM is not subject to mitigation planning requirements under 40 CFR § 51.930(b) for this event and the 2024 annual PM_{2.5} NAAQS.

Narrative Conceptual Model

IDEM’s demonstration provided a narrative conceptual model for each event to describe how emissions from Canadian wildfires caused PM_{2.5} exceedances at the South Bend-Shields Dr monitoring site.

The conceptual model for these events is supported by media reports, daily average PM_{2.5} concentration plots overlaid with the National Oceanic and Atmospheric Administration’s Hazard Mapping System smoke plumes and active fire locations in AirNowTech, surface and upper-level

meteorological maps, and Canadian Wildland Fire Information System active fire maps. These analyses support the conclusion that wildfire smoke was the primary contributor to the PM_{2.5} exceedances recorded at the South Bend-Shields Dr monitor on June 18, 2023, June 27-30, 2023, July 16, 2023, and July 25, 2023.

The discussion of the interaction of wildfire smoke formation and meteorology resulting in smoke impacts at the monitor in the South Bend CBSA is consistent with the EPA’s recommendations (Guidance on the Preparation of Exceptional Events Demonstrations for Wildfire Events that May Influence Ozone Concentrations (EPA, 2016) and the PM_{2.5} Wildland Fire Exceptional Events Tiering Document (EPA, 2024)). The regulatory significance of the proposed data exclusion is also discussed as required by 40 CFR 50.14(c)(3)(i) (see demonstration pp. 1-10).

June 18, 2023, Narrative Conceptual Model Overview

On May 27, 2023, the Canadian Wildland Fire Information System began to report significant wildfire activity throughout the southwest border of Ontario and northeast across Quebec to the Gulf of St. Lawrence in Canada. IDEM’s demonstration describes a cold front from the northwest bringing smoke from southern Canada into the South Bend area. From the west, a low-pressure system from the Plains approached the area, lifting a warmer front across the South Bend area followed by a cold front with Canadian wildfire smoke out ahead of it, allowing the transport of Canadian wildfire smoke to South Bend. The AirNowTech’s PM_{2.5} concentration map (see demonstration, pp. 23-24, Fig. 2.1.7) show the extent and coverage of elevated PM_{2.5} concentrations and wildfire smoke across the Midwest, including the South Bend area, impacting PM_{2.5} values on June 18, 2023, supporting the meteorological transport narrative in the demonstration.

Table 4: Narrative Conceptual Model for June 18, 2023

Evidence	Demonstration Citation	Summary of the EPA’s Review	Criterion Met?
Description of event(s) causing exceedance or violation	Demonstration pp. 13-18	IDEM described wildfire complexes in Quebec and Ontario, Canada which caused PM _{2.5} exceedances on June 18, 2023.	Y
Discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s)	Demonstration pp. 13-18, 24-26	IDEM included meteorological surface and upper air (500 and 850 mb heights) analyses as well as visible satellite imagery depicting wildfire smoke, which aligned with PM _{2.5} concentrations at ground level. HYSPLIT trajectory analyses were also provided with back trajectories that showed wildfire smoke transport from areas of wildfire activity in Canada.	Y

Evidence	Demonstration Citation	Summary of the EPA's Review	Criterion Met?
Discusses the interaction of emissions and meteorology	Demonstration pp. 13-18	IDEM included daily average PM _{2.5} concentration plots overlaid with the NOAA's HMS smoke plumes and active fire locations in AirNowTech, surface and upper air meteorological maps, Canadian Wildland Information System and Fire Information for Resource Management System active fire maps, and a meteorological narrative describing how the wildfire emissions from Canada were transported to the South Bend area.	Y
Explains regulatory significance	Demonstration pp. 1, 5-10	IDEM explained these days are regulatory significant for initial area designations for the 2024 annual PM _{2.5} NAAQS.	Y

June 27-30, 2023, Narrative Conceptual Model Overview

Throughout the event, extreme fire danger conditions were reported across regions of Canada, with significant, out of control wildfire activity recorded in Quebec. IDEM's demonstration describes a low-pressure system over the eastern portion of the US with a high-pressure system settling in over the Hudson Bay. The flow around these two meteorological features allowed transport of Canadian wildfire smoke from Quebec to a wide swath of the eastern US, including South Bend, IN. The strengthening high-pressure system allowed smoke to build up in the area, causing elevated PM_{2.5} concentrations in South Bend, IN. These meteorological features allowed transport and stagnation of Canadian wildfire smoke into eastern portions of the US, including South Bend, IN. The June 27-29, 2023, HYSPLIT analyses intersected the source regions of the Canadian wildfires which supports the meteorological transport narrative in the demonstration.

Table 5: Narrative Conceptual Model for June 27-30, 2023

Evidence	Demonstration Citation	Summary of the EPA’s Review	Criterion Met?
Description of event(s) causing exceedance or violation	Demonstration pp. 41-48	IDEM described wildfire complexes in Quebec and southeastern Canada that caused PM _{2.5} exceedances on June 27-30, 2023.	Y
Discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s)	Demonstration pp. 41-48	IDEM included meteorological surface and upper air (500 and 850 mb heights) analyses as well as visible satellite imagery depicting wildfire smoke, aligning with PM _{2.5} concentrations at ground level. HYSPLIT trajectory analyses were also provided with back trajectories that showed wildfire smoke transport from areas of wildfire activity in Canada.	Y
Discusses the interaction of emissions and meteorology	Demonstration pp. 41-48	IDEM included daily average PM _{2.5} concentration plots overlaid with the NOAA’s HMS smoke plumes and active fire locations in AirNowTech, surface and upper-level meteorological maps, Canadian Wildland Fire Information System active fire maps, and a meteorological narrative describing transport of wildfire emissions from Canada to the South Bend area.	Y
Explains regulatory significance	Demonstration pp. 1, 5-10	IDEM explained these days are regulatory significant for initial area designations for the 2024 annual PM _{2.5} NAAQS.	Y

July 16, 2023, Narrative Conceptual Model Overview

Leading up to and throughout the event, active fires continued burning in the British Columbia and Alberta provinces in Canada. IDEM’s demonstration describes a front which brought Canadian wildfire smoke from southwestern Canada to the South Bend-Shields Dr monitor on July 16, 2023. Upper air maps also strongly support northwesterly flow from southwestern Canada into the South Bend, IN area. These meteorological features allowed transport of Canadian wildfire smoke into the South Bend area on July 16, 2023. HYSPLIT trajectories depict the transport of wildfire smoke to the monitor from the northwest, while AirNowTech imagery shows heavy smoke in the South Bend-Shields Dr monitor area on July 16, 2023, supporting the meteorological transport narrative in the demonstration.

Table 6: Narrative Conceptual Model for July 16, 2023

Evidence	Demonstration Citation	Summary of the EPA’s Review	Criterion Met?
Description of event(s) causing exceedance or violation	Demonstration pp. 83-87	IDEM described wildfire complexes in British Columbia and Alberta, Canada which caused PM _{2.5} exceedances on July 16, 2023.	Y
Discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s)	Demonstration pp. 83-87	IDEM included meteorological surface and upper air (500 and 850 mb heights) analyses as well as visible satellite imagery depicting wildfire smoke, which aligned with PM _{2.5} concentrations at ground level. HYSPLIT trajectory analyses were also provided with back trajectories that showed wildfire smoke transport from areas of wildfire activity in Canada.	Y
Discusses the interaction of emissions and meteorology	Demonstration pp. 83-87	IDEM included daily average PM _{2.5} concentration plots overlaid with the NOAA’s HMS smoke plumes and active fire locations in AirNowTech, surface and upper air (500 and 850 mb heights) meteorological maps, Canadian Wildland Information System active fire maps, and a meteorological narrative describing how wildfire emissions from Canada were transported to the South Bend area.	Y
Explains regulatory significance	Demonstration p. 1, 5-10	IDEM explained these days are regulatory significant for initial area designations for the 2024 annual PM _{2.5} NAAQS.	Y

July 25, 2023, Narrative Conceptual Model Overview

Leading up to and throughout the event, active fires continued burning in the British Columbia and Alberta provinces in Canada. IDEM’s demonstration describes a cold front moving from the northwest to the southeast through Indiana, funneling wildfire smoke from the British Columbia and Alberta provinces into the South Bend area for several days, including July 25, 2023. Also, upper air maps strongly support northwesterly flow from southwestern Canada into the South Bend area. The July 25,

2023, HYSPLIT analyses intersected the source regions of the Canadian wildfires supporting the meteorological transport narrative in the demonstration.

Table 7: Narrative Conceptual Model for July 25, 2023

Evidence	Demonstration Citation	Summary of the EPA’s Review	Criterion Met?
Description of event(s) causing exceedance or violation	Demonstration pp. 108-113	IDEM described wildfire complexes in British Columbia and Alberta, Canada that caused PM _{2.5} exceedances on July 25, 2023.	Y
Discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s)	Demonstration pp. 108-113	IDEM included meteorological surface and upper air (500 and 850 mb heights) analyses as well as visible satellite imagery depicting wildfire smoke, which aligned with PM _{2.5} concentrations at ground level. HYSPLIT trajectory analyses were also provided with back trajectories showing wildfire smoke transport from areas of wildfire activity in Canada.	Y
Discusses the interaction of emissions and meteorology	Demonstration pp. 108-113	IDEM included daily average PM _{2.5} concentration plots overlaid with the NOAA’s HMS smoke plumes and active fire locations in AirNowTech, surface and upper-level air (500 and 850 mb heights) meteorological maps, Canadian Wildland Information System active fire maps, and a meteorological narrative describing how wildfire emissions from Canada were transported to the South Bend area.	Y
Explains regulatory significance	Demonstration p. 1, 5-10	IDEM explained this day is regulatory significant for initial area designations for the 2024 annual PM _{2.5} NAAQS.	Y

Clear Causal Relationship and Supporting Analyses

IDEM’s demonstration included the EPA’s Tiering Tool analysis, comparison of event days with historical concentrations, HYSPLIT trajectory analyses (forward and backward), Aerosol Optical Depth satellite and visible satellite imagery, NOAA’s HMS smoke plumes and active fire locations in AirNowTech, General Additive Model, High-Resolution Rapid Refresh-Smoke mode, BlueSky model, carbon and PM_{2.5} timeseries, media articles, IDEM air quality forecasts, and NOAA’s Satellite Smoke Narrative to demonstrate the clear causal relationship between the Canadian wildfires and the exceedances recorded at the South Bend-Shields Dr monitor. Based on the measured PM_{2.5} values, as well as other criteria, all the days requested for exclusion in IDEM’s demonstration are Tier I.

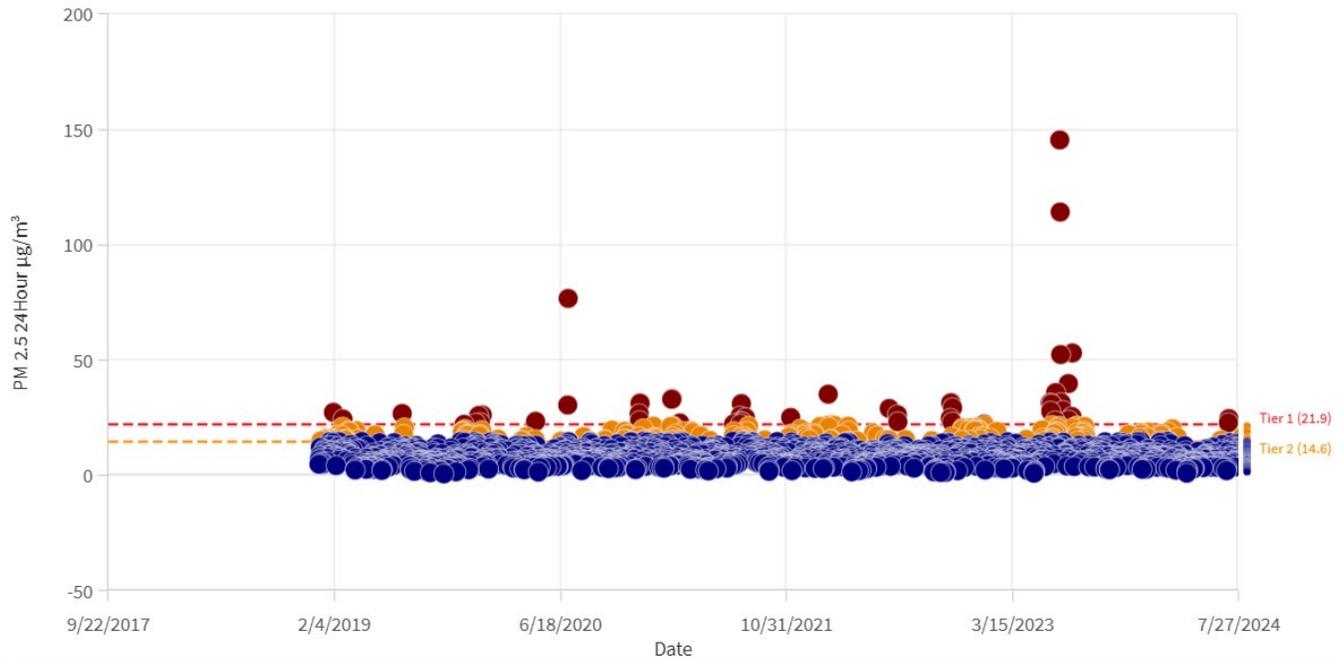
Comparison with Historical Concentrations

The demonstration includes a comparison with historical concentrations, as required by 40 CFR § 50.14(c)(3)(iv)(C). The demonstration compares daily average PM_{2.5} concentrations during the wildfire smoke events on June 18, 2023, June 27-30, 2023, July 16, 2023, and July 25, 2023, to the 2019-2023 5-year average which illustrate the enhancement of PM_{2.5} concentrations on the event days compared to monitor concentrations during the rest of the year. As shown in Figures 1 and 2 below, daily concentrations of exceedance days for the South Bend-Shields Dr monitor are compared to the Tier 1 cutoff for justification of the demonstration's tier selection.

Figure 1: The EPA's PM_{2.5} Tiering Tool for Exceptional Events Analysis (South Bend-Shields Dr Monitor-June)

AQS Site ID 181410015

R and I Fire Flags Excluded From Tiering Calculation



AQS data last updated 4/24/2025

Figure 2: The EPA’s PM_{2.5} Tiering Tool for Exceptional Events Analysis (South Bend-Shields Dr Monitor-July)

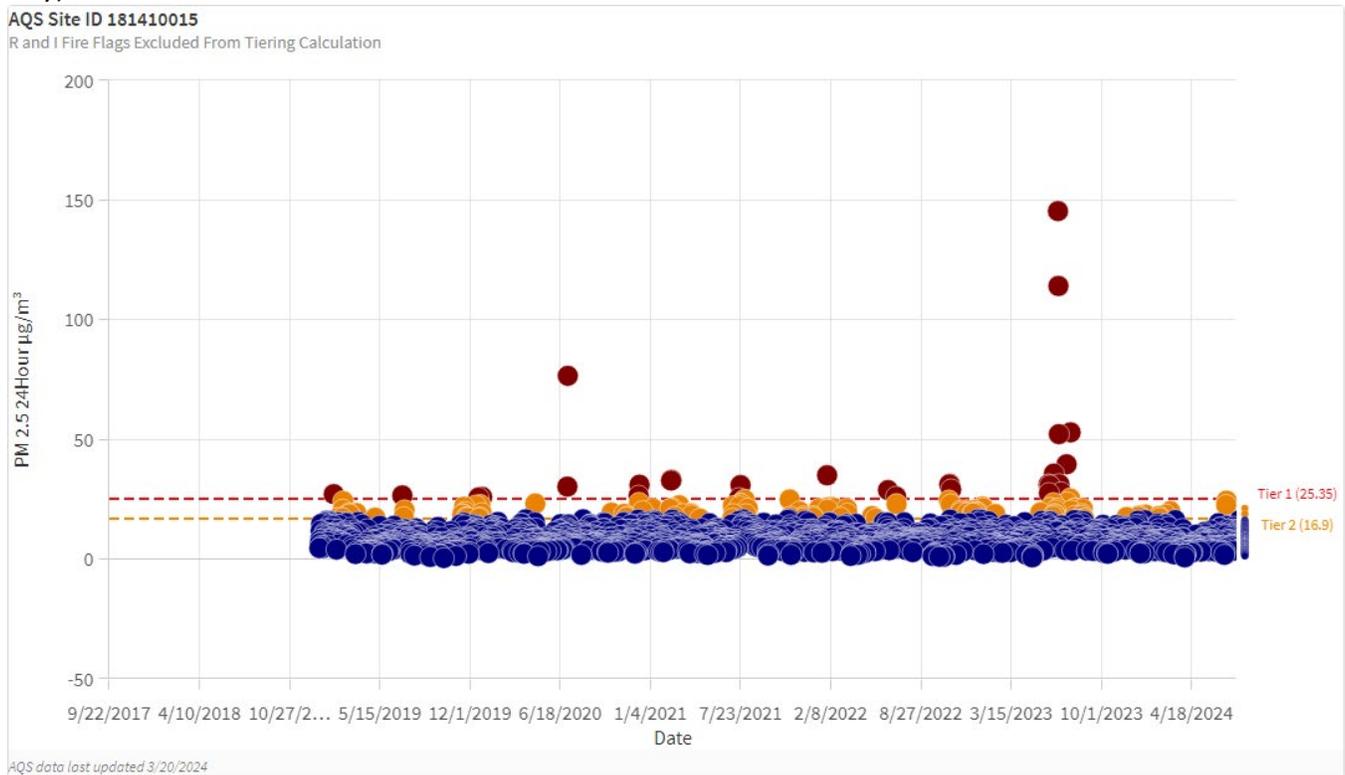


Table 8: Summary of Tiering for Relevant Monitoring Days

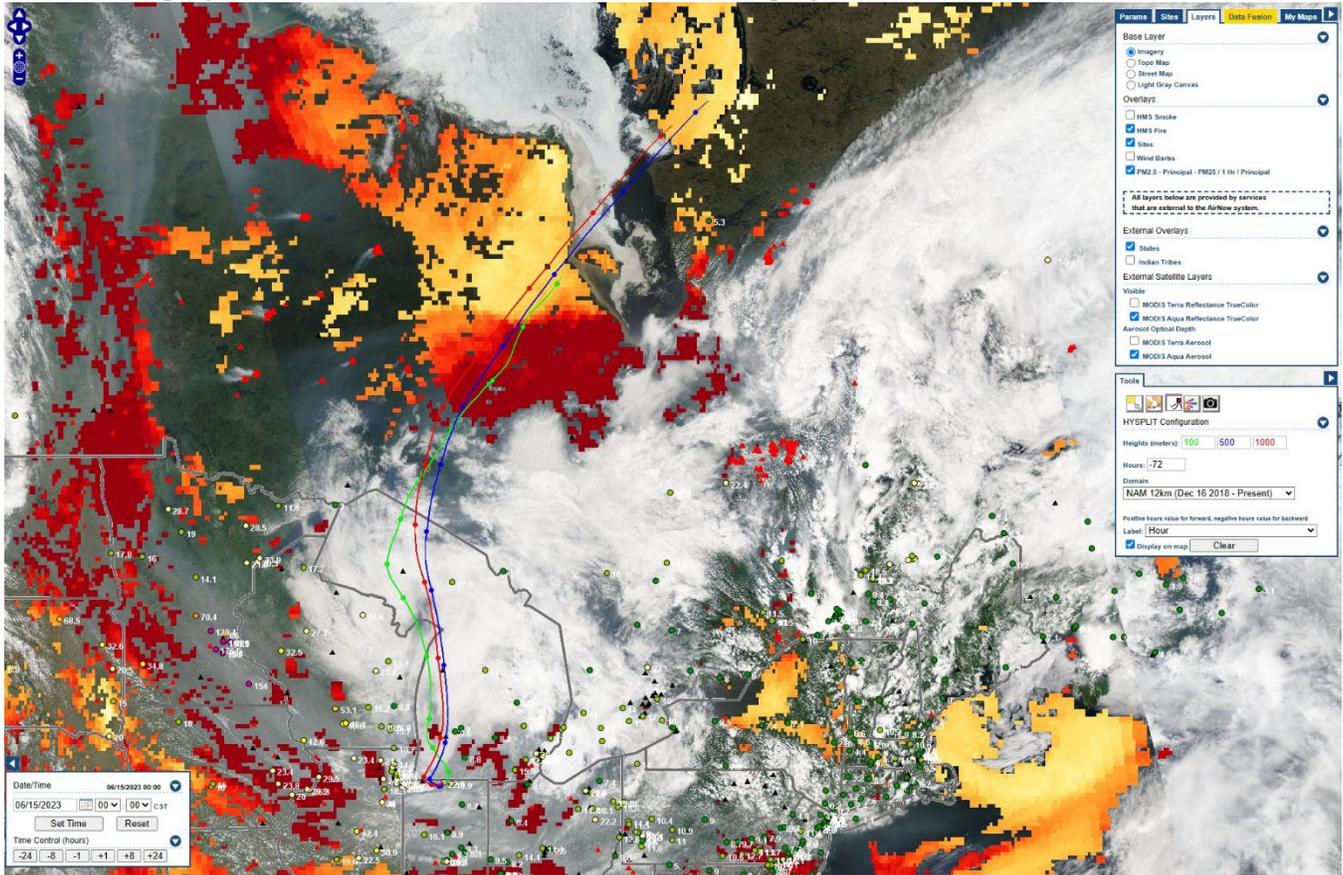
Tiering	Demonstration Citation	Tiering Details	Tiers
Tiering for South Bend-Shields Dr monitoring site on June 18, 2023, June 27-30, 2023, July 16, 2023, and July 25, 2023.	Demonstration p. 8	IDEM cited the EPA’s Tiering Tool. Flags excluded from the calculation included R and I Fire Flags. The tiering thresholds were determined by analyzing the full 5-year dataset from 2019-2023.	1

June 18, 2023, Clear Causal Relationship and Supporting Analyses

Evidence of Transport of Wildfire Emissions from the Wildfire to the Monitors

For the exceedance on June 18, 2023, IDEM’s demonstration presents evidence of smoke transport from Ontario wildfires to the South Bend area. Analyses are supported by AOD and visible satellite imagery (see demonstration, p. 26, Figs. 2.1.9), HRRR-Smoke analyses (see demonstration p. 27, Fig. 2.1.10), and GAM analyses (see demonstration, p. 28, Fig. 2.1.11). The forward and backward trajectories provided by IDEM demonstrate that smoke was transported to South Bend, IN from the north. The EPA further analyzed backward trajectories for June 18, 2023, and demonstrated transport of smoke from the Ontario province in Canada (see Fig. 3 below). Smoke is also evident on visible satellite imagery.

Figure 3: Backward trajectories at 100-, 500-, and 1,000-meter heights starting on June 18, 2023, at 12:00 AM CDT from South Bend, IN. Trajectories were developed in AirNowTech's Navigator tool and the map was overlaid with hourly PM_{2.5} concentrations, HMS fire satellite detected hotspots, visual satellite imagery from June 15, 2023, and AOD satellite imagery from June 15, 2023.



Evidence that the Wildfire Emissions Affected the Monitors

PM_{2.5} concentration maps, GAM analyses, and carbon concentration timeseries show the transport of Canadian wildfire smoke transport to the South Bend area and depict the smoke impacts at the monitor level on June 18, 2023 (see demonstration, pp. 24-32, Figs. 2.1.7, 2.1.11, 2.1.13-2.1.14). Additionally, IDEM included media articles, IDEM air quality forecasts, and NOAA Smoke Text Products discussing the wildfire plume impacts in the Midwest region of the United States as well as the South Bend area (see demonstration, pp. 33-40).

Table 9: Clear Causal Relationship for June 18, 2023

Evidence	Demonstration Citation, if applicable	Summary of the EPA’s Review	Criterion Met?
Comparison of Event-Related and Historical Concentrations⁶			
Tiering Tool plots across 5-years (2019-2023) and daily average PM _{2.5} concentration plots	Demonstration pp. 5-10, 13, 29	PM _{2.5} concentrations on June 18, 2023, exceeded 1.5 times the Tiering Threshold, confirming Tier 1 and distinct elevated concentrations.	Y
Evidence that the Fire Emissions were Transported to the Monitor(s)⁷			
HYSPLIT Trajectories, Satellite Imagery (AOD, visible, HMS smoke plumes, and detections of active fires in Canada) and the HRRR-Smoke model	Demonstration pp. 24-27; TSD Figure 3 above	HYSPLIT trajectories (backward and forward), satellite imagery, and HRRR-Smoke model outputs demonstrated smoke transport from Ontario to South Bend, IN on June 18, 2023.	Y

⁶ The EPA’s Guidance Prescribed Fire on Wildland that May Influence Ozone and Particulate Matter Concentrations (Prescribed Fire Guidance) offers examples of analyses that may be used to satisfy the comparison to historical concentrations criterion for wildland fires that may have influenced PM concentrations, including: Comparison of concentration on the claimed event day(s) with a set of similar days, a percentile of event-related concentration(s) relative to annual and/or seasonal data; 99th percentile over 5 years or fourth highest within one year; Description of past high data points labeled as being associated with previous exceptional events, suspected exceptional events, other unusual occurrences, or high pollution days due to normal emissions, with basic evidence to support claims and recognition that a history of concentrations above the standard could indicate additional evidence needed; Indication of how typically observed non-event diurnal or seasonal pattern differs, if such a deviation occurred, due to the event, with more weight given to effective statistical summaries that characterize non-event, high-concentration day historical data and the differences seen on event days over anecdotal or general assertions.

⁷The EPA’s Prescribed Fire Guidance offers examples of analyses that may be used to show emissions transport from wildland fires that may have influenced PM concentrations, including: Atmospheric trajectory analysis/modeling; Satellite imagery of plume with evidence of plume impacting the ground; Satellite imagery of plume with evidence of plume impacting the ground; Provision of additional information, such as analyses of relevant meteorological conditions (e.g., wind speed and direction at the height of the smoke plume) further supporting the clear causal relationship rule element.

Evidence	Demonstration Citation, if applicable	Summary of the EPA's Review	Criterion Met?
Evidence that the Fire Emissions Affected the Monitor(s)⁸			
PM _{2.5} surface concentrations, GAM analyses, carbon concentration timeseries, media articles, NOAA smoke narratives, and IDEM air quality forecasts	Demonstration pp. 23-24, 27-40	Spatial distribution of PM _{2.5} across the Midwest demonstrates regional impacts of wildfire smoke at the ground level on June 18, 2023. Additionally, IDEM's GAM analyses, carbon concentration timeseries, media articles, NOAA smoke narratives, and IDEM air quality forecasts show the wildfire smoke plume impacts at the surface.	Y
Concluding Statement			
Inclusion of a concluding statement that explains how the demonstration meets the relevant statutory and regulatory criteria	Demonstration pp. 40-41	IDEM's demonstration summarizes how the demonstration meets the requirements of the Exceptional Event Rule and meets the clear causal criteria.	Y

June 27-30, 2023, Clear Causal Relationship and Supporting Analyses

Evidence of Transport of Wildfire Emissions from the Wildfire to the Monitors

For the exceedances on June 27-30, 2023, IDEM's demonstration presents evidence of smoke transport from Quebec wildfires to the South Bend area. Analyses are supported by forward and backward HYSPLIT trajectories overlaid on PM_{2.5} concentrations, smoke contours, and fire data (see demonstration, pp. 52-54, Figs. 2.2.13-2.2.15), AOD and visible satellite imagery (see demonstration, pp. 56-57, Figs. 2.2.17-2.2.20), HRRR-Smoke analyses (see demonstration, pp. 57-59, Fig. 2.2.21), and GAM analyses (see demonstration, pp. 59-61, Fig. 2.2.22). HYSPLIT trajectories illustrate transport of smoke from eastern Canada to the South Bend area on June 27-29, 2023. Smoke lingered in the area

⁸ The EPA's Prescribed Fire Guidance offers examples of analyses that may be used to show impacts from emissions of wildland fires at the monitor, including: Plots of elevated fire-related species near the monitor (e.g., PM, carbon monoxide); Elevated light extinction measurements at or near the monitoring site; Photographic evidence of ground-level smoke at the monitor; The timing and spatial distribution of fire-related pollutants shown with data from multiple monitoring sites; Differences in carbon monoxide: nitrogen oxides ratios, and/or; PM speciation data that indicate fire impacts; Inclusion of matching day analyses, statistical regression models, or photochemical models, as needed.

under a high-pressure system until June 30, 2023, when later in the evening a frontal system began to clear out the smoke. Additionally, the smoke is evident on the satellite imagery.

Evidence that the Wildfire Emissions Affected the Monitors

The PM_{2.5} concentration maps, GAM analyses, and carbon concentration timeseries show the transport of the smoke from Canadian wildfires to South Bend, IN and depict the smoke impacts at the monitor level leading up to and on June 27-30, 2023 (see demonstration, pp. 49-66, Figs. 2.2.9-2.2.12, 2.2.22-2.2.27). Additionally, IDEM included media articles, NOAA smoke narratives, and IDEM air quality forecasts discussing the wildfire plume impacts in the eastern US as well as in South Bend, IN (see demonstration, pp. 67-81).

Table 10: Clear Causal Relationship for June 27-30, 2023

Evidence	Demonstration Citation, if applicable	Summary of the EPA’s Review	Criterion Met?
Comparison of Event-Related and Historical Concentrations			
Tiering Tool plots across 5-years (2019-2023) and daily average PM _{2.5} concentration plots	Demonstration pp. 5-10, 42, 61	PM _{2.5} concentrations on June 27-30, 2023, exceeded 1.5 times the Tiering Threshold, confirming Tier 1 and distinct elevated concentrations.	Y
Evidence that the Fire Emissions were Transported to the Monitor(s)			
HYSPLIT Trajectories, Satellite Imagery (AOD, visible, HMS smoke plumes, and detections of active fires in Canada), and the HRRR-Smoke model	Demonstration pp. 51-59	HYSPLIT trajectories (backward and forward), satellite imagery, and the HRRR-Smoke model demonstrated smoke transport from Quebec to South Bend, IN on June 27-30, 2023.	Y

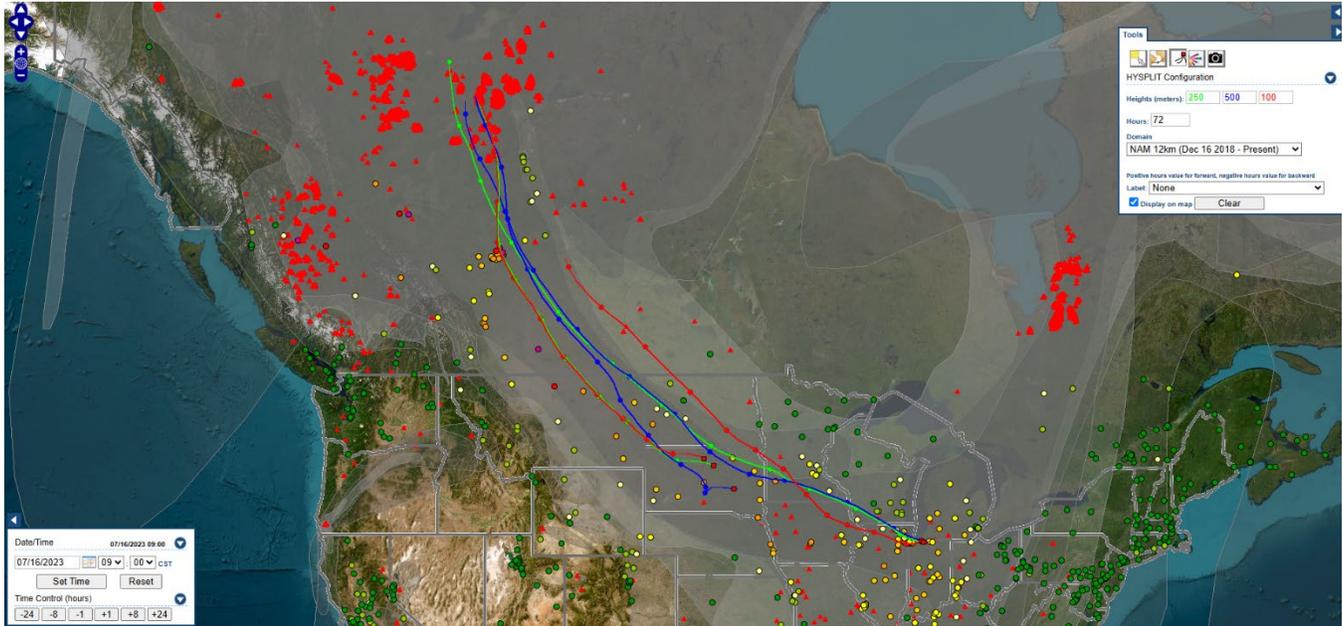
Evidence	Demonstration Citation, if applicable	Summary of the EPA's Review	Criterion Met?
Evidence that the Fire Emissions Affected the Monitor(s)			
PM _{2.5} surface concentrations, GAM analyses, carbon concentration timeseries, media articles, NOAA smoke narratives, and IDEM air quality forecasts	Demonstration pp. 49-51, 59-81	Spatial distribution of PM _{2.5} across the Midwest demonstrates regional impacts of wildfire smoke at the ground level on June 27-30, 2023. Additionally, IDEM's GAM analyses, carbon concentration timeseries, media articles, NOAA smoke narratives, and IDEM air quality forecasts show the wildfire smoke plume impacts at the surface.	Y
Concluding Statement			
Inclusion of a concluding statement that explains how the demonstration meets the relevant statutory and regulatory criteria	Demonstration pp. 81-82	IDEM's demonstration summarizes how the demonstration meets the requirements in the Exceptional Event Rule and meets the clear causal criteria.	Y

July 16, 2023, Clear Causal Relationship and Supporting Analyses

Evidence of Transport of Wildfire Emissions from the Wildfire to the Monitors

For the exceedance on July 16, 2023, IDEM's demonstration presents evidence of smoke transport from British Columbia and Alberta, Canada wildfires to the South Bend area (see demonstration, p. 89-92, Figs. 2.3.7-2.3.10). Analyses are supported by forward and backward HYSPLIT trajectories overlaid on PM_{2.5} concentrations, smoke contours, and fire data (see demonstration, p. 89, Fig. 2.3.7), AOD and visible satellite imagery (see demonstration, p. 90, Fig. 2.3.8), HRRR-Smoke analyses (see demonstration, p. 91, Fig. 2.3.9), and GAM analyses (see demonstration, p. 92, Fig. 2.3.10). HYSPLIT trajectories illustrate transport of smoke from western Canada to the South Bend area on July 16, 2023, and smoke is evident on the satellite imagery. The EPA further analyzed backward and forward trajectories for July 16, 2023, and demonstrated transport of smoke from fires in western Canada (see Fig. 4 below), which align with surface PM_{2.5} concentrations and HMS smoke plumes.

Figure 4: Backward trajectories at 250-, 500-, and 1,000-meter heights starting on July 16, 2023, at 09:00 AM CDT from South Bend, IN. Forward trajectories at 250- 500-, and 1,000-meter heights starting on July 13, 2023, at 09:00 AM CDT from wildfire locations in Canada. The 09:00 AM hour on July 16, 2023, had the highest PM_{2.5} concentrations for the 24-hour period at the South Bend-Shields Dr monitor. Trajectories were developed in AirNow-Tech’s Navigator tool and the map was overlaid with hourly PM_{2.5} concentrations, HMS fire satellite detected hotspots, and HMS smoke plumes from July 16, 2023.



Evidence that the Wildfire Emissions Affected the Monitors

The PM_{2.5} concentration maps, GAM analysis, and carbon concentration timeseries show the transport of the smoke from Canadian wildfires to the South Bend area, depicting smoke impacts at the monitor level on July 16, 2023 (see demonstration, pp. 88-95, Figs. 2.3.6, 2.3.10-2.3.12). Additionally, IDEM included media articles, IDEM air quality forecasts, and NOAA smoke narratives discussing the wildfire plume impacts across the US, including the Great Lakes region and the South Bend area (see demonstration, pp. 96-106).

Table 11: Clear Causal Relationship for July 16, 2023

Evidence	Demonstration Citation, if applicable	Summary of the EPA’s Review	Criterion Met?
Comparison of Event-Related and Historical Concentrations			
Tiering Tool plots across 5-years (2019-2023) and daily average PM _{2.5} concentration plots	Demonstration pp. 5-10, 83, 93	PM _{2.5} concentrations on July 16, 2023, exceeded 1.5 times the Tiering Threshold, confirming Tier 1 and distinct elevated concentrations.	Y

Evidence	Demonstration Citation, if applicable	Summary of the EPA's Review	Criterion Met?
Evidence that the Fire Emissions were Transported to the Monitor(s)			
HYSPLIT Trajectories, Satellite Imagery (AOD, visible, HMS smoke plumes, and detections of active fires in Canada), and the HRRR-smoke model	Demonstration pp. 88-91	HYSPLIT trajectories (backward and forward), satellite imagery, and the HRRR-Smoke model demonstrated smoke transport from western Canada to South Bend, IN on July 16, 2023.	Y
Evidence that the Fire Emissions Affected the Monitor(s)			
PM _{2.5} surface concentrations, GAM analyses, carbon concentration timeseries, media articles, NOAA smoke narratives, and IDEM air quality forecasts	Demonstration pp. 88, 92-106	Spatial distribution of PM _{2.5} across the Midwest demonstrates regional impacts of wildfire smoke at the ground level on July 16, 2023. Additionally, IDEM's GAM analyses, carbon concentration timeseries, media articles, NOAA smoke narratives, and IDEM air quality forecasts show the wildfire smoke plume impacts at the surface.	Y
Concluding Statement			
Inclusion of a concluding statement that explains how the demonstration meets the relevant statutory and regulatory criteria	Demonstration pp. 106-108	IDEM's demonstration summarizes how the demonstration meets the requirements in the Exceptional Event Rule and meets the clear causal criteria.	Y

July 25, 2023, Clear Causal Relationship and Supporting Analyses

Evidence of Transport of Wildfire Emissions from the Wildfire to the Monitors

For the exceedance on July 25, 2023, IDEM's demonstration presents evidence of smoke transport from the Alberta and British Columbia, Canada wildfires to the South Bend area (see demonstration, pp. 114-119, Figs. 2.4.8-2.4.11). Analyses are supported by forward and backward HYSPLIT trajectories overlaid on PM_{2.5} concentrations, smoke contours, and fire data (see demonstration, p. 116, Fig. 2.4.8), AOD and visible satellite imagery (see demonstration, p. 117, Fig. 2.4.9), HRRR-Smoke analysis (see

demonstration, p. 118, Fig. 2.4.10), and GAM analysis (see demonstration, p. 119, Fig. 2.4.11). HYSPLIT trajectories illustrate the transport of smoke from western and southwestern Canada to the South Bend area on July 25, 2023. Additionally, smoke is evident on the included satellite imagery.

Evidence that the Wildfire Emissions Affected the Monitors

PM_{2.5} concentration maps, GAM analysis, and carbon concentration timeseries show the transport of smoke from Canadian wildfires to South Bend, IN and depict smoke impacts at the monitor level on July 25, 2023 (see demonstration, pp. 114-122, Fig. 2.4.7, 2.4.11-2.4.13). Additionally, IDEM included media articles, IDEM air quality forecasts and NOAA smoke narratives discussing the wildfire plume impacts across much of the Midwest region of the United States, including the South Bend area (see demonstration, pp. 123-137).

Table 12: Clear Causal Relationship for July 25, 2023

Evidence	Demonstration Citation, if applicable	Summary of the EPA’s Review	Criterion Met?
Comparison of Event-Related and Historical Concentrations			
Tiering Tool plots across 5-years (2019-2023) and daily average PM _{2.5} concentration plots	Demonstration pp. 5-10, 109, 119	PM _{2.5} concentrations on July 25, 2023, exceeded 1.5 times the Tiering Threshold, confirming Tier 1 and distinct elevated concentrations.	Y
Evidence that the Fire Emissions were Transported to the Monitor(s)			
HYSPLIT Trajectories, Satellite Imagery (AOD, visible, HMS smoke plumes, and detections of active fires in Canada), and the HRRR-smoke model	Demonstration pp. 114-118	HYSPLIT trajectories (backward and forward), satellite imagery, and the HRRR-smoke model demonstrated smoke transport from Alberta and British Columbia, Canada to South Bend, IN on July 25, 2023.	Y

Evidence	Demonstration Citation, if applicable	Summary of the EPA’s Review	Criterion Met?
Evidence that the Fire Emissions Affected the Monitor(s)			
PM _{2.5} surface concentrations, GAM analyses, carbon concentration timeseries, media articles, NOAA smoke narratives, and IDEM air quality forecasts	Demonstration pp. 114, 118-137	Spatial distribution of PM _{2.5} across the Midwest demonstrates regional impacts of wildfire smoke at the ground level on July 25, 2023. Additionally, IDEM’s GAM analyses, carbon concentration timeseries, media articles, NOAA smoke narratives, and IDEM air quality forecasts show the wildfire smoke plume impacts at the surface.	Y
Concluding Statement			
Inclusion of a concluding statement that explains how the demonstration meets the relevant statutory and regulatory criteria	Demonstration pp. 137-139	IDEM’s demonstration summarizes how the demonstration meets the requirements in the Exceptional Event Rule and meets the clear causal criteria.	Y

Not Reasonably Controllable or Preventable

The EER presumes that wildfire events on wildland are not reasonably controllable or preventable per 40 CFR § 50.14(b)(4). IDEM’s demonstration provided evidence that the wildfire event meets the definition of a wildfire. Specifically, IDEM included information highlighting the number of acres burned in Canada in 2023 compared to historical averages since 1970 and reporting from the CIFFC on the Canadian national preparedness level with moderate to heavy fire danger throughout the Quebec, Ontario, British Columbia and Alberta provinces. IDEM states that “ignited by lightning on June 1, the fires in Quebec saw surging growth in late June and early July, a period when temperatures were unusually high and drought gripped the region” (see demonstration, pg. 18). Therefore, the documentation sufficiently demonstrates that the event was not reasonably controllable and not reasonably preventable.

Table 13: Not Reasonably Controllable or Preventable

Evidence	Demonstration Citation, if applicable	Summary of the EPA’s Review	Criterion Met?
Does the event meet the EER definition of a wildfire?	Demonstration Appendix A, media articles	The wildfires were caused by natural factors such as lightning.	Y
Did the wildfire occur predominately on wildland as defined in the EER?	Demonstration Appendix A, media articles	Wildfires occurred in undeveloped areas of Quebec, Ontario, British Columbia and Alberta, Canada meeting the definition of wildland.	Y
Concluding Statement			
Inclusion of a concluding statement that explains how the demonstration meets the relevant statutory and regulatory criteria	Demonstration pp. 36, 70, 97, 126	IDEM notes how the wildfire events were on wildland and not reasonably controllable or preventable.	Y

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.” IDEM’s demonstration includes documentation that the event meets the definition of a wildfire and occurred predominantly on wildland, including satellite imagery, land use maps, graphical data, media, and news reporting, demonstrating that the fires were unplanned and occurred in areas with little human activity or development (see demonstration pp. 17, 48, 87, 112, Appendix A). IDEM has therefore shown that the event was a natural event.

Table 14: Natural Event or Human Activity Unlikely to Recur at a Particular Location

Evidence	Demonstration Citation	Summary of the EPA’s Review	Criterion Met?
Does the event meet the EER definition of a wildfire?	Demonstration Appendix A, media articles	Wildfires were unplanned ignitions caused by natural factors, as defined in the EER. These fires that impacted the monitor also occurred on wildland.	Y
Concluding Statement			
Inclusion of a concluding statement that explains how the demonstration meets the relevant statutory and regulatory criteria	Demonstration pp. 36-37, 70, 97-98, 126	IDEM’s evidence demonstrated the fires were natural events occurring predominantly on wildland.	Y

CONCLUSION

The EPA has reviewed the documentation provided by IDEM to support claims that smoke from wildfires in Canada caused exceedances of the 2024 annual PM_{2.5} standard at the South Bend-Shields Dr monitoring site on June 18, 2023, June 27-30, 2023, July 16, 2023, and July 25, 2023. The EPA has determined that the flagged exceedances at these monitoring sites on these days satisfy the exceptional events 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. The EPA has also determined that the IDEM has satisfied the procedural requirements for data exclusion from comparison to the NAAQS.