

**Exceptional Events Demonstration
Addressing the 2024 Annual Primary Fine
Particles (PM_{2.5}) National Ambient Air
Quality Standard (NAAQS)**

**Lake County, Indiana
(2023-2025 Three-Year Period)**

Developed By:

The Indiana Department of
Environmental Management (IDEM)

MONTH 2026

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TABLE OF CONTENTS

1.0 INTRODUCTION	1
1.1 OVERVIEW	1
1.2 CLEAN AIR ACT REQUIREMENTS.....	1
1.3 EXCEPTIONAL EVENTS RULE REQUIREMENTS	2
1.4 LOCATION AND DESCRIPTION OF LAKE COUNTY, IN PM _{2.5} MONITORS	3
1.5 REQUESTED EXCEPTIONAL EVENT SMOKE DAYS FOR LAKE COUNTY, IN	10
2.0 EXCEPTIONAL EVENTS ELEMENTS OVERVIEW – LAKE COUNTY DEMONSTRATION	16
2.1 WILDFIRE SMOKE IMPACTS	17
3.0 CLEAR CAUSAL RELATIONSHIP BETWEEN EVENT AND MONITORED DATA	21
3.1 ANALYSIS DESCRIPTION FOR CLEAR CAUSAL EVIDENCE	21
3.2 JULY 31, 2025, PM _{2.5} EVENT.....	23
3.2.1 Episode Description	23
3.2.2 Active Wildland Fires	26
3.2.3 Meteorological Episode Overview	27
3.2.4 Hourly Monitoring Readings – PM _{2.5} and Speciated Data	29
3.2.5 AOD and Satellite Analyses	32
3.2.6 Smokelyze/GAM Modeling Analysis.....	35
3.2.7 HYSPLIT Backward Trajectories	37
3.2.8 HRRR Model.....	38
3.2.9 Media Mentions.....	40
3.2.10 Summary	40
3.3 AUGUST 5, 2025 PM _{2.5} EVENT	40
3.3.1 Episode Description	40
3.3.2 Active Wildland Fires	44
3.3.3 Meteorological Episode Overview	45
3.3.4 Hourly Monitoring Readings – PM _{2.5} and Speciated Data	46
3.3.5 AOD and Satellite Analyses	49
3.3.6 Smokelyze/GAM Modeling Analysis.....	52
3.3.7 HYSPLIT Backward Trajectories	54
3.3.8 HRRR Model.....	55
3.3.9 Media Mentions.....	56
3.3.10 Summary	57
4.0 NOT REASONABLY CONTROLLABLE OR PREVENTABLE	58
5.0 NATURAL EVENT OR HUMAN EVENT NOT LIKELY TO RECUR	59
6.0 PUBLIC PARTICIPATION	61
7.0 SUMMARY	63

Attachment A: Public Participation Process Documentation

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1.0 Introduction

1.1 Overview

On August 14, 2025, the Indiana Department of Environmental Management (IDEM) submitted to United States Environmental Protection Agency (U.S. EPA) Region 5 an Exceptional Events (EE) demonstration for exceedances of the 2024 primary annual fine particles (PM_{2.5}) National Ambient Air Quality Standard (NAAQS) on certain dates in 2022 and 2023, during the 2022- 2024 design value (DV) period, at three PM_{2.5} air quality monitoring sites in Lake County, Indiana. The three affected PM_{2.5} ambient monitoring sites include: Gary-Madison St (180890031), East Chicago-Marina (180890034), and Hammond-167th St (180890036). On February 3, 2026, U.S. EPA Region 5 concurred with IDEM's demonstration for certain dates in 2022 and 2023 and noted Lake County's attainment for the 2022-2024 design value period with the adjusted data. However, during 2025, there were several wildfire smoke events that impacted the Lake County area. Unusually high concentrations were experienced at the monitors on July 31, 2025, and August 5, 2025, as a direct result of wildfire smoke events from Manitoba, Saskatchewan and other provinces in Canada. As a result, even with the adjusted data for 2023, the 2023-2025 design values for the three Lake County monitors exceed the 2024 annual PM_{2.5} NAAQS.

The purpose of this document is to request exclusion of certain PM_{2.5} data from 2025 due to wildfire smoke impacts measured at the Gary-Madison St (180890031), East Chicago-Marina (180890034), and Hammond-167th St (180890036) PM_{2.5} ambient monitors. The higher PM_{2.5} concentrations from these wildfires contributed to an exceedance of the 2024 annual PM_{2.5} NAAQS, causing Lake County to have a 2023–2025 design value over the 2024 annual primary PM_{2.5} NAAQS. The event-influenced data has regulatory significance and should therefore be excluded from regulatory determinations. IDEM therefore requests U.S. EPA's concurrence with the exclusion of July 31, 2025, and August 5, 2025, for regulatory determinations, as described in this demonstration.

1.2 Clean Air Act Requirements

On February 7, 2024, U.S. EPA revised the primary annual PM_{2.5} NAAQS, lowering the standard from 12.0 to 9.0 micrograms per cubic meter (µg/m³).¹ The 2024 primary annual PM_{2.5} standard is met when the annual weighted quarterly average averaged over three years is less than or equal to 9.0 µg/m³, as stated in Title 40, §50.20 of the Code of Federal Regulations (40 CFR §50.20).² U.S. EPA intends to make designation decisions for the 2024 annual PM_{2.5} NAAQS based on the most recent three years of quality-assured, certified air quality data in U.S. EPA's Air Quality System (AQS).

When “exceptional” events influence monitoring data and cause exceedances or violations of the NAAQS, air agencies can request the exclusion of event-influenced data,

¹ 89 FR 16380, March 6, 2024: <https://www.govinfo.gov/content/pkg/FR-2024-03-06/pdf/2024-02637.pdf>

² <https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-50/section-50.20>

and the U.S. EPA can agree to exclude these data, from the data set used for certain regulatory decisions. In advance of the February 7, 2025, deadline for states to submit nonattainment area designation recommendations for the 2024 annual PM_{2.5} NAAQS, U.S. EPA asked state and local air agencies to submit demonstrations to exclude days impacted by exceptional events from consideration in the designations process. In response, Indiana is submitting this exceptional events demonstration to exclude certain data from the 2023-2025 design value calculations that will be relied upon by the state in making its recommendation. The exclusion of this data will impact U.S. EPA's designation process as the events are part of the 2023-2025 design values by which U.S. EPA will make its final attainment designations under the annual PM_{2.5} standard.

Exceptional events are defined in the Clean Air Act (CAA) as events that affect air quality, are not reasonably controllable or preventable, and are either natural events or caused by human activity unlikely to recur. CAA section 319(b) allows for the exclusion of air quality monitoring data influenced by exceptional events from use in actions with regulatory significance, including determinations of exceedances or violations of the NAAQS. The Exceptional Events Rule (codified at 40 CFR 50.1, 50.14 and 51.930)³ contains definitions, procedural requirements, requirements for air agency demonstrations, criteria for the U.S. EPA's approval of the exclusion of event-influenced air quality data, and requirements for air agencies to take appropriate and reasonable actions to protect public health from exceedances or violations of the NAAQS. Under the Exceptional Events Rule, the following core statutory elements of CAA section 319(b) must be met when requesting U.S. EPA exclude event-related concentrations from regulatory determinations:

- 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;
- The event was not reasonably controllable or preventable; and,
- The event was a human activity that is unlikely to recur at a particular location or was a natural event.

1.3 Exceptional Events Rule Requirements

U.S. EPA addresses the exclusion of event-influenced air quality data from certain regulatory decisions in the Exceptional Events Rule and provides associated guidance to states, including *the PM_{2.5} Wildland Fire Exceptional Events Tiering Document*⁴. In accordance with the Exceptional Events Rule and 40 CFR § 50.14(c)(3)(iv)(A–E), air agencies must include the following information in demonstrations:

³ See U.S. EPA's rule for the "Treatment of Data Influenced by Exceptional Events" (81 FR 68216, October 3, 2016) at <https://www.govinfo.gov/content/pkg/FR-2016-10-03/pdf/2016-22983.pdf> and 40 CFR 50.1, 50.14 and 51.930 at <https://www.govinfo.gov/content/pkg/CFR-2021-title40-vol2/pdf/CFR-2021-title40-vol2-part50.pdf>.

⁴ <https://www.epa.gov/system/files/documents/2024-04/final-pm-fire-tiering-4-30-24.pdf>.

- 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 the requirement in paragraph (c)(3)(iv)(B) of this section. The Administrator shall not require a State to prove a specific percentile point in the distribution of data;
- D. A demonstration that the event was both not reasonably controllable and not reasonably preventable;
- E. A demonstration that the event was a human activity that is unlikely to recur at a location or was a natural event; and,
- F. Documentation that the submitting air agency followed the public comment process.

This exceptional events demonstration satisfies the above requirements in showing that the wildfire smoke during 2025 caused elevated PM_{2.5} concentrations throughout the state that resulted in a 2023-2025 three-year design value above the 2024 annual PM_{2.5} NAAQS at three Lake County air quality monitors. A description of the Lake County monitors is provided in Section 1.4. Air quality monitoring data requested for exclusion represent “Tier 1” and “Tier 2” smoke days defined by the Exceptional Events Rule, as presented in Section 1.5. Information to support the exclusion of the data is presented in Sections 2.0 through 7.0.

1.4 Location and Description of Lake County, IN PM_{2.5} Monitors

During 2025, Indiana operated 34 PM_{2.5} monitoring sites, with 30 of those monitors collecting hourly data. Five monitors operated in Lake County, however, because of siting and sampling criteria, only four are comparable to the annual NAAQS: East Chicago-Franklin School (180890006), Gary-Madison St (180890031), East Chicago-Marina (180890034), and Hammond-167th St (180890036). East Chicago-Franklin School and Gary-Madison St are 1 in 3-day monitors, East Chicago-Marina and Hammond-167th St are continuous monitors. Figure 1.1 shows the 2025 monitor locations throughout the state of Indiana with the Lake County monitors highlighted in yellow. Figure 1.2 shows the PM_{2.5} monitors in Lake County comparable to the annual NAAQS.

Figure 1.1 – Indiana’s 2025 PM_{2.5} Air Monitoring Network

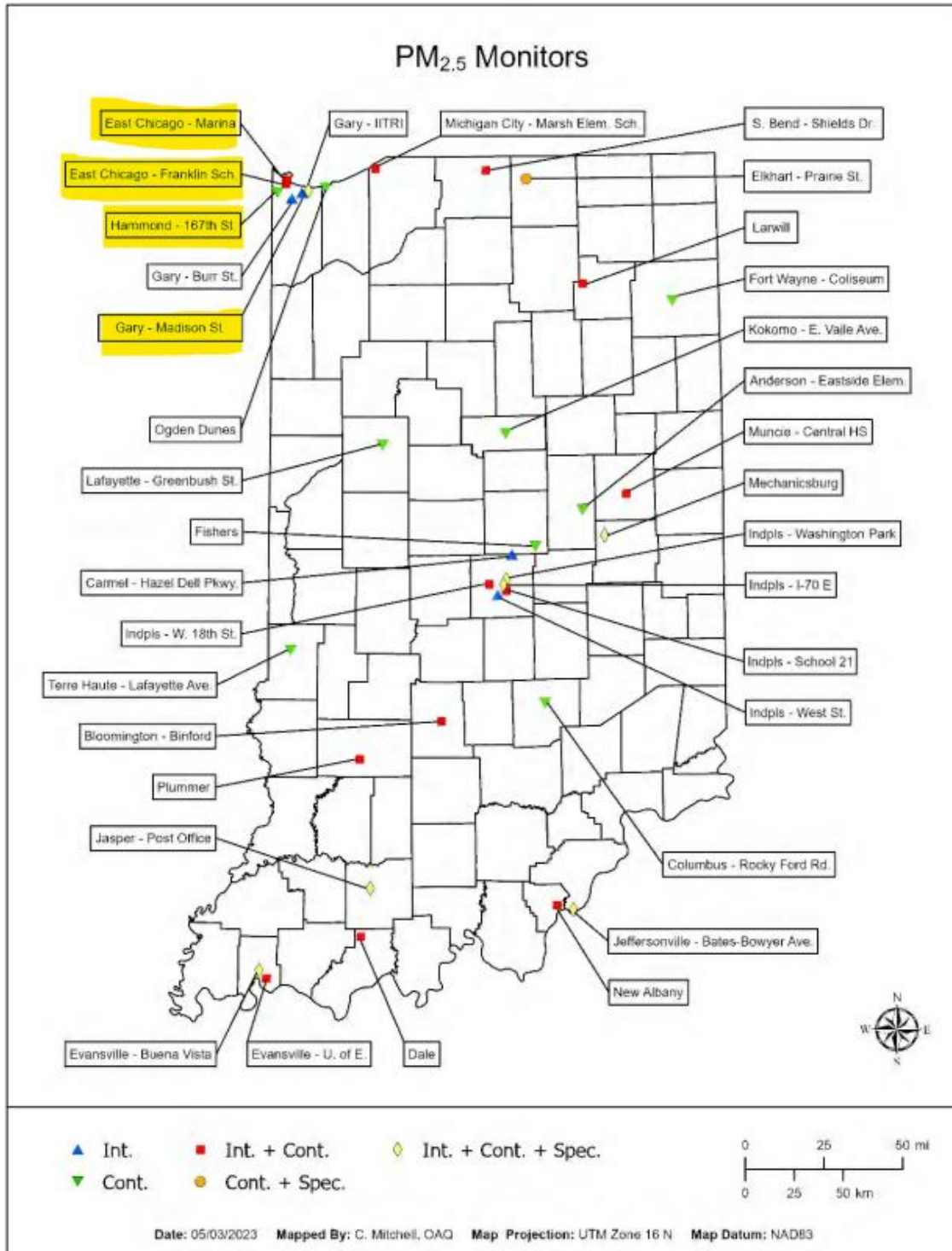


Figure 1.2 –Lake County 2025 PM_{2.5} Air Monitors Comparable to the Annual NAAQS

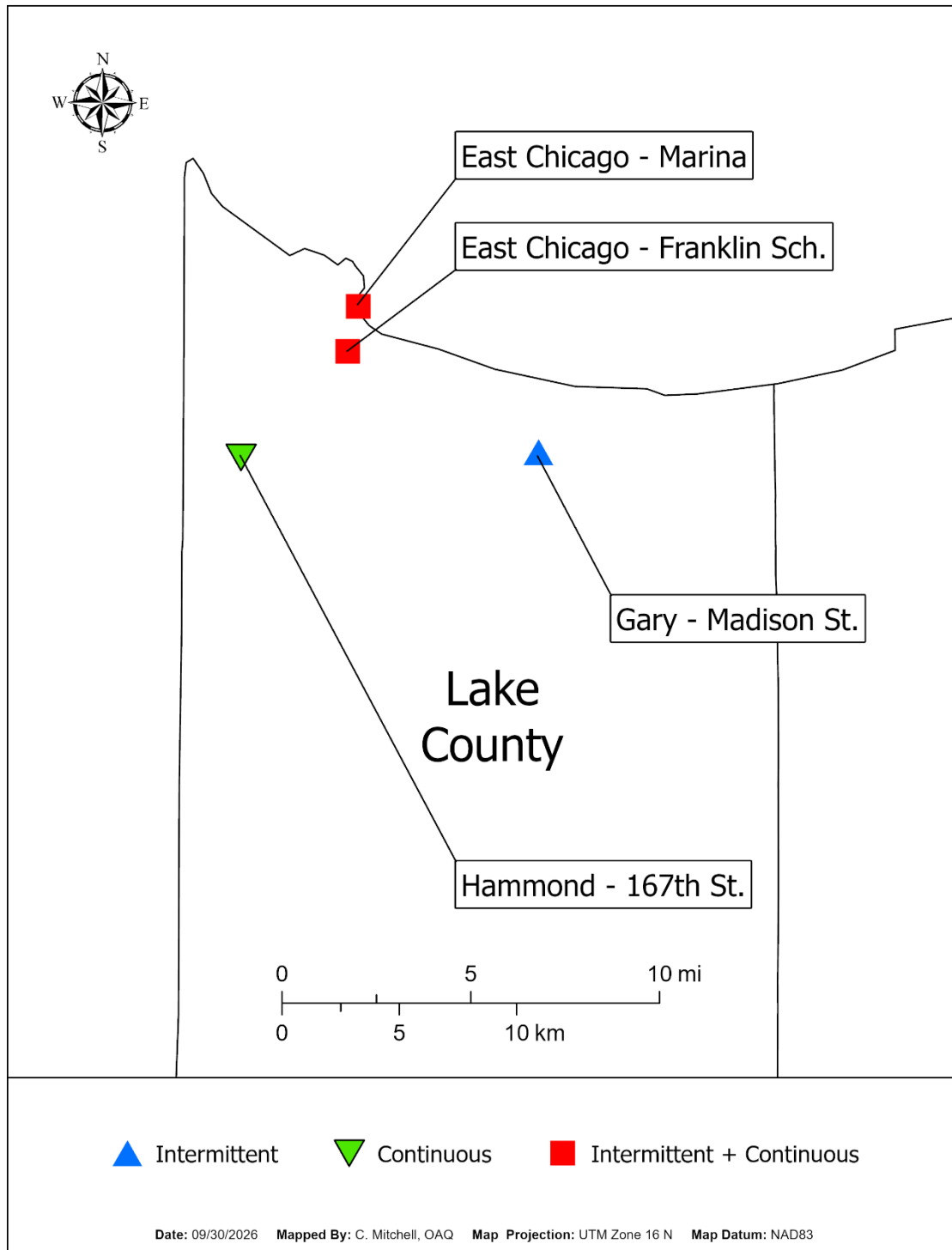


Figure 1.3 provides a satellite map showing the East Chicago-Franklin School PM_{2.5} monitor. The monitor is located at 2400 Cardinal Dr at the now-called Washington Elementary School. This is located northwest of The Gary Airport. The monitor location is indicated by the red marker.

Figure 1.3 – Maps of East Chicago-Franklin School PM_{2.5} Monitor

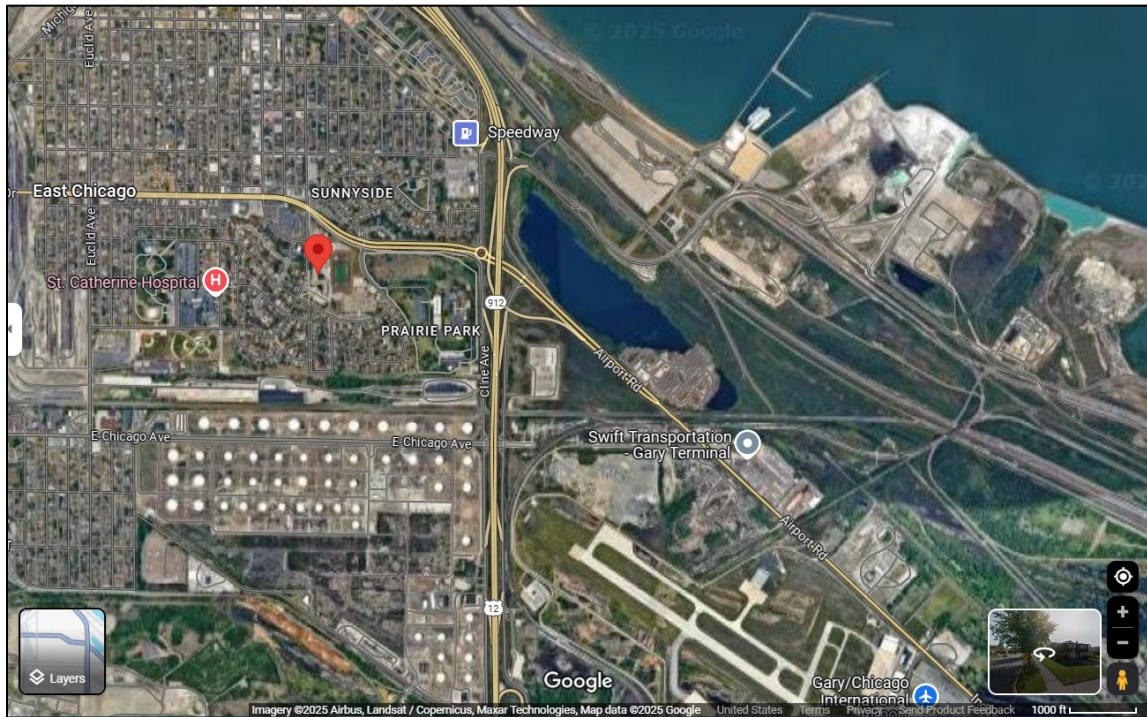


Figure 1.4 provides a satellite map showing the Gary-Madison Street PM_{2.5} monitor, which is in a residential area of Gary. The monitor location is indicated by the red marker.

Figure 1.4 – Maps of Gary-Madison Street PM_{2.5} Monitor

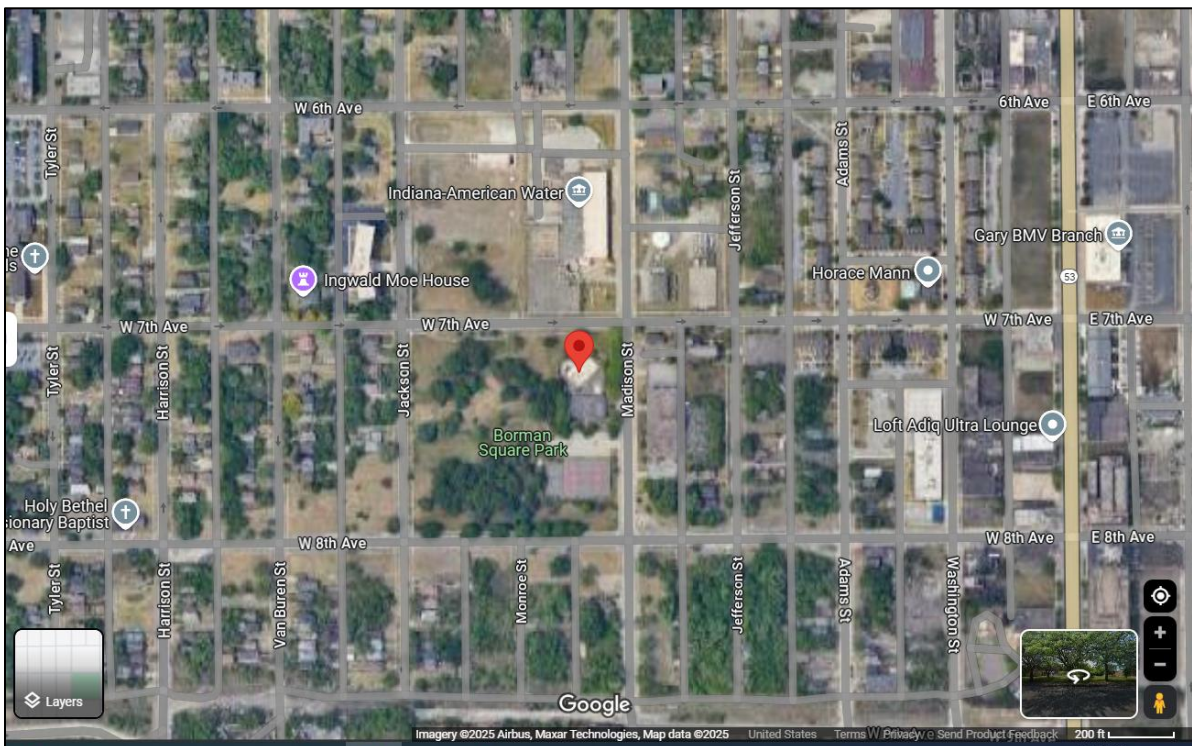
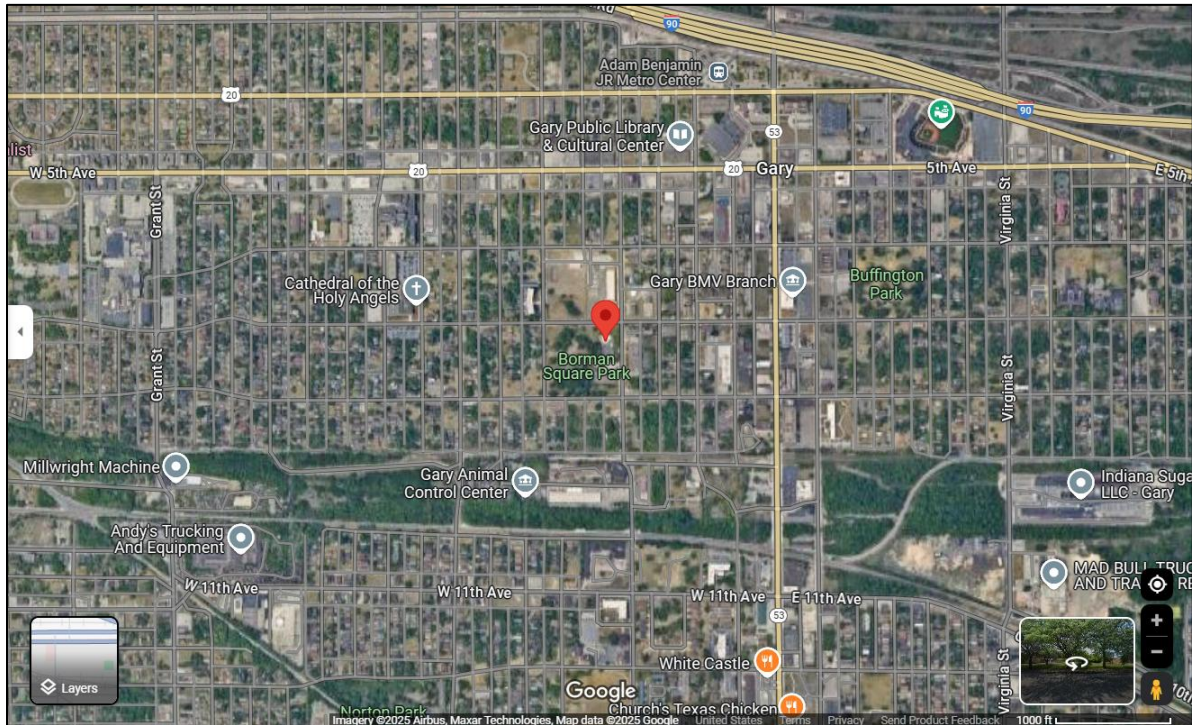


Figure 1.5 provides a satellite map showing the East Chicago-Marina PM_{2.5} monitor. This monitor is located near the Harbor Yacht Club, Ameristar Casino, and Cliffs Indiana Harbor Steel. The monitor location is indicated by the red marker.

Figure 1.5 – Maps of East Chicago-Marina PM_{2.5} Monitor

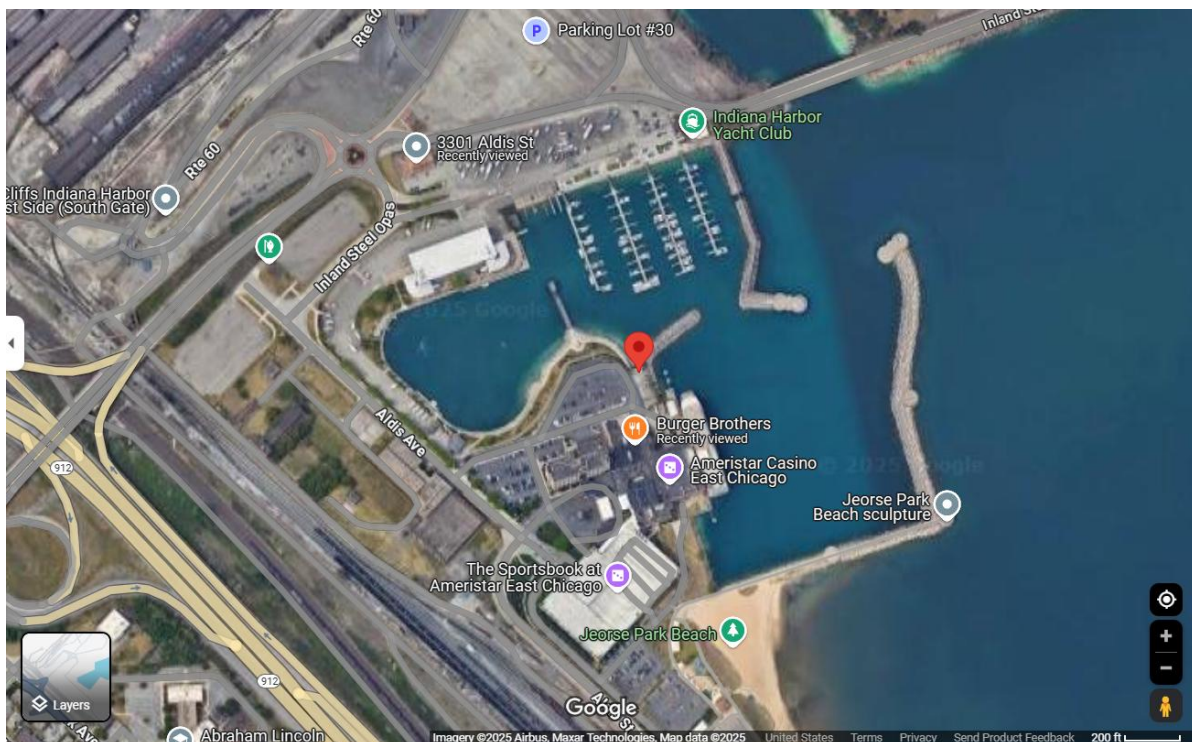
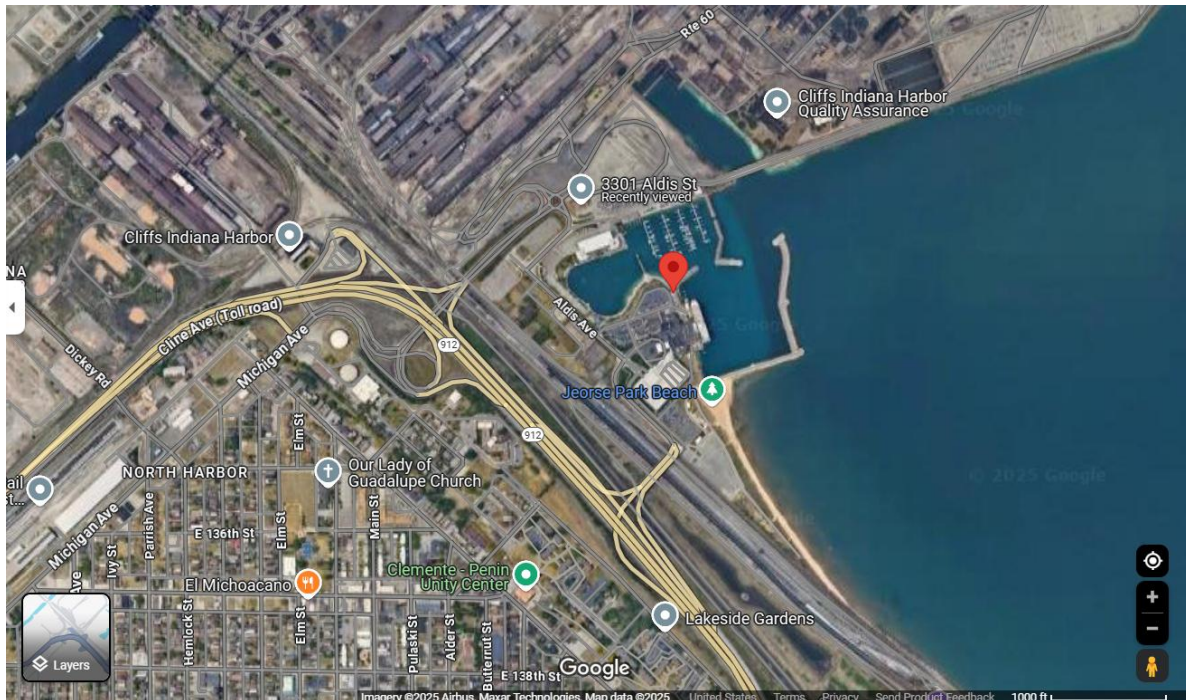
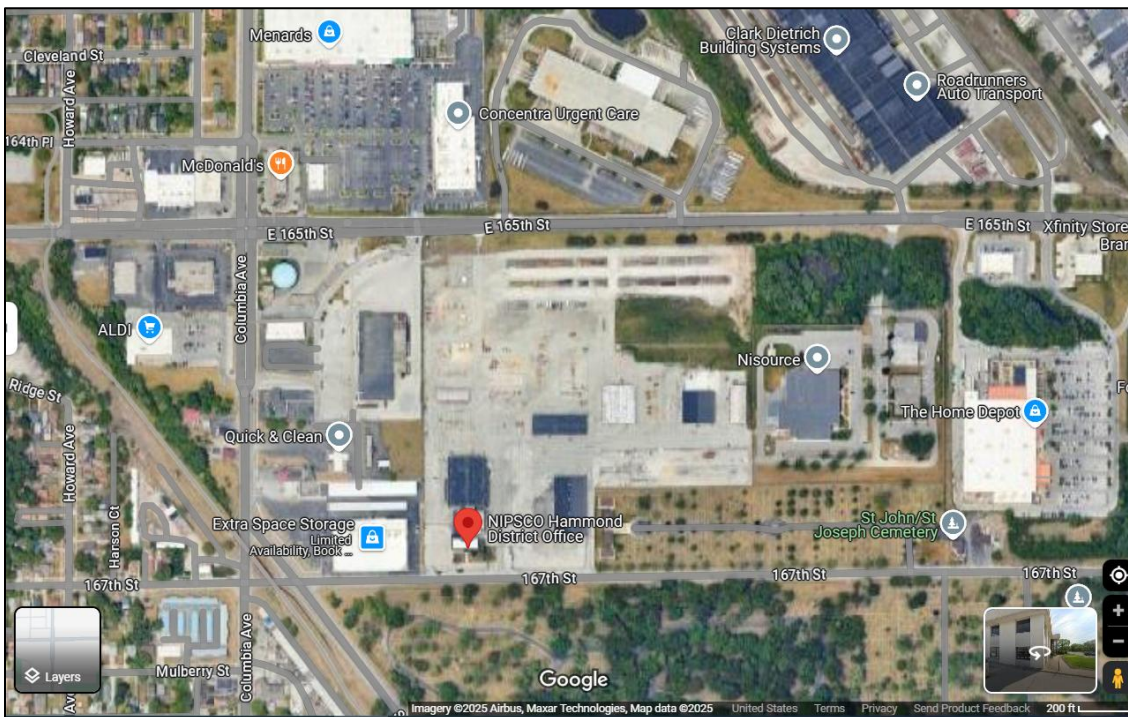
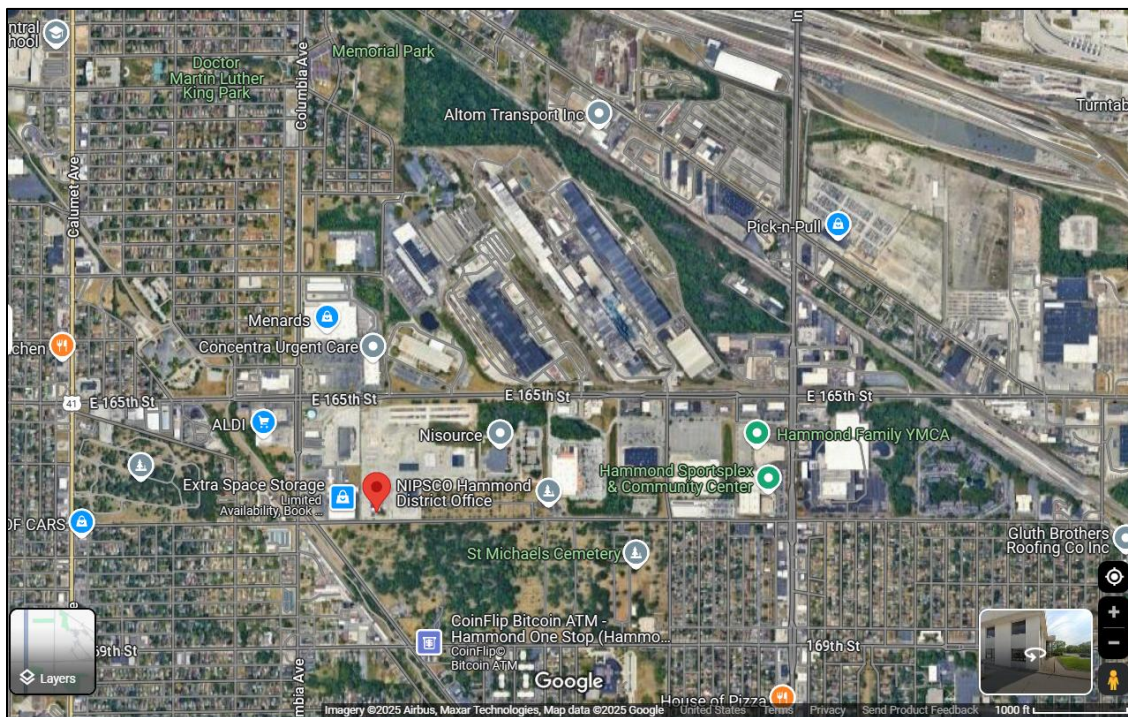


Figure 1.6 provides a satellite map showing the Hammond 167th Street PM_{2.5} monitor. This monitor is located in a mixed industrial and residential area. The monitor location is indicated by the red marker.

Figure 1.6 – Maps of Hammond-167th Street PM_{2.5} Monitor



1.5 Requested Exceptional Event Smoke Days for Lake County, IN

IDEM is requesting July 31, 2025, and August 5, 2025, as Exceptional Event smoke days for Lake County, Indiana, based on analyses using U.S. EPA exceptional events tools. Figures 1.7 through 1.9 are site level scatter plots for the three Lake County monitors included in this demonstration. The plots are obtained using U.S. EPA's PM_{2.5} Tiering Tool for Exceptional Events Analysis⁵, showing the daily PM_{2.5} concentrations compared with U.S. EPA's tiering thresholds (AQS data last updated on June 1, 2026). U.S. EPA's webpage explains that the tiering thresholds are:

1. Based on the most recent, complete 5-year period 2021-2025. This tool does not have a minimum data completeness requirement. If a site has less than five years of data, please work with the corresponding EPA regional office to determine the appropriate tiering analysis.
2. Calculated at the site level. Specifically, U. S. EPA uses site-level aggregated daily values consistent with PM_{2.5} NAAQS data handling (40 CFR 50, Appendix N, 3.0(d))⁶. For identifying which site-days to exclude from the tier threshold calculations, we consider the raw data record for all monitors at a site. If any hour of the day at any monitor at the site has an R (Request Exclusion) flag or a fire-related I (Informational) flag, then we exclude the site-level aggregated daily value from the tier threshold calculations. Fire-related R flags include RT (Wildfire – U.S.), RF (Fire – Canadian), RG (Fire – Mexico/Central America), RH (Fireworks), RM (Prescribed Fire), and RP (Structural Fire).
3. 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 with all R flagged and fire-related I flagged days excluded. Tier 1 demonstrations are appropriate for 24-hour PM_{2.5} greater than or equal to 1.5 times the threshold determined above, Tier 2 demonstrations are appropriate for 24-hour PM_{2.5} greater than or equal to the threshold but less than 1.5 times the threshold, and Tier 3 demonstrations are appropriate for 24-hour PM_{2.5} less than the threshold.

As can be seen in the figures, there are several Tier 1 and Tier 2 days that can be considered for exceptional event analysis, provided smoke impacts were realized at that monitoring site during those times.

⁵ <https://www.epa.gov/air-quality-analysis/pm25-tiering-tool-exceptional-events-analysis>

⁶ <https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-50/appendix-Appendix%20N%20to%20Part%2050>

Figure 1.7 – PM_{2.5} Tiering Data for Gary-Madison Street

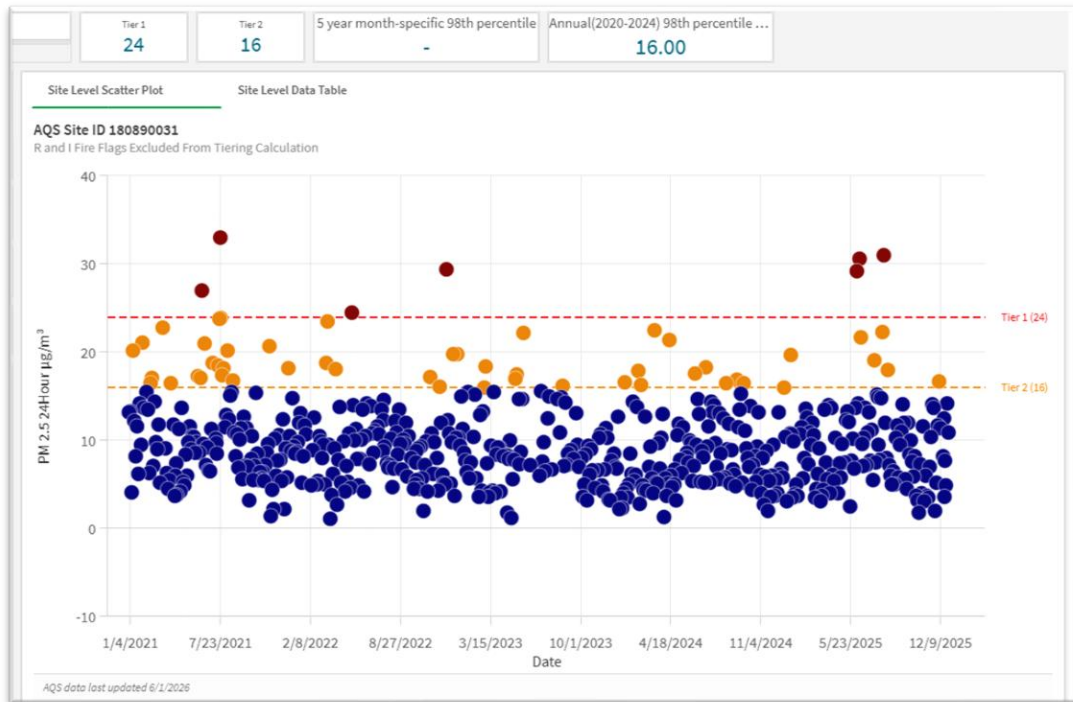


Figure 1.8 – PM_{2.5} Tiering Data for East Chicago-Marina

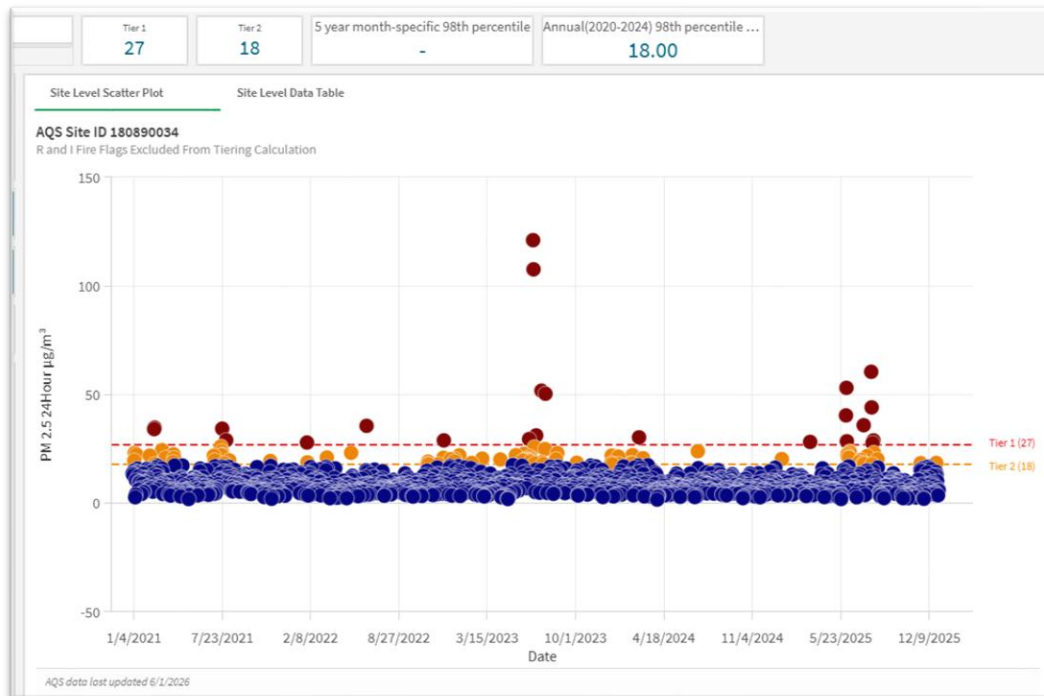
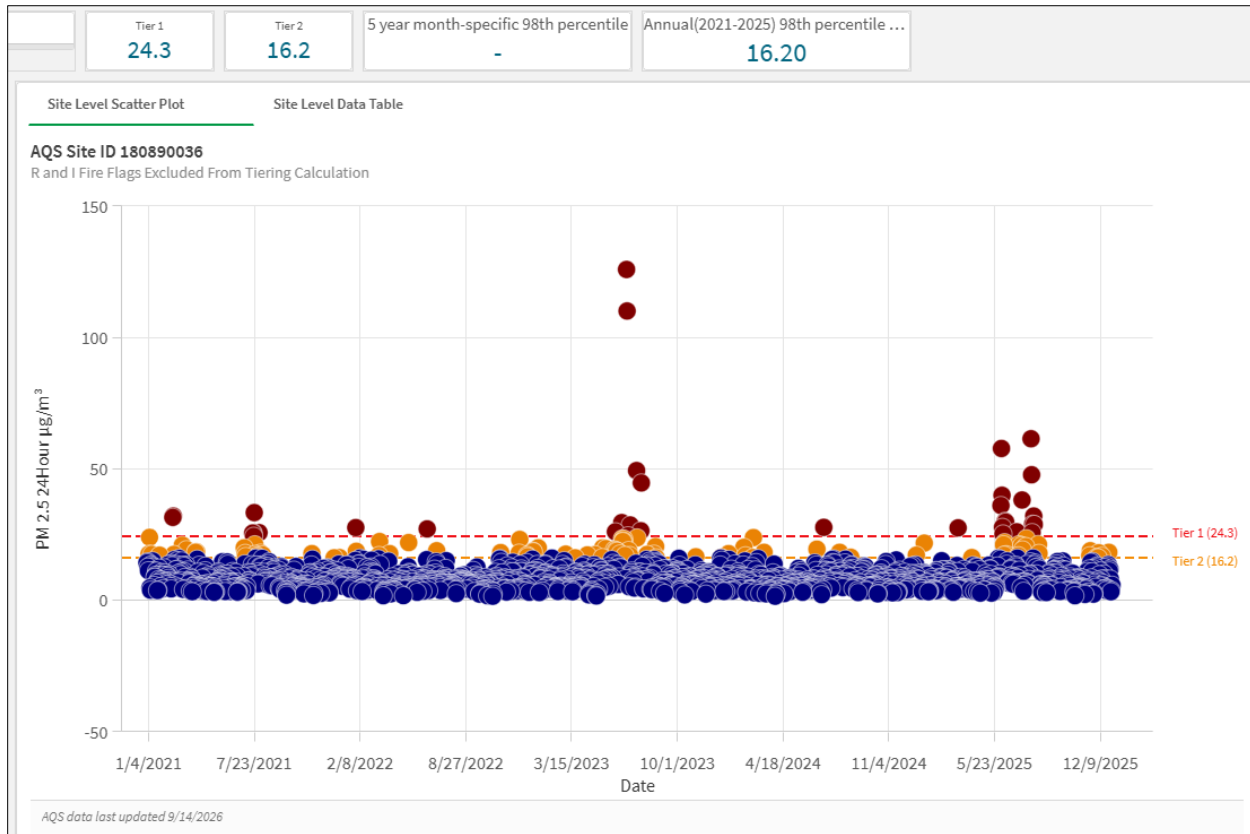


Figure 1.9 – PM_{2.5} Tiering Data for Hammond-167th Street



The 2023-2025 annual PM_{2.5} mean values are shown in Table 1.1 through 1.4 for all four Lake County monitors. This data was retrieved using U.S. EPA’s Exceptional Events Design Value Tool⁷. The data shows annual mean values above 9.0 µg/m³ for 2023 and 2025 at three monitors, which coincide with heavier smoke events that impacted Indiana. While the annual mean value for 2024 shows lower PM_{2.5} concentrations, lighter smoke impacts still adversely affected the state and increased the overall design value of the Lake County monitors.

Table 1.1 – Current 2023-2025 East Chicago-Franklin Annual PM_{2.5} Mean Values

Year	Annual Mean Value (µg/m ³)	24-Hour 98 th Percentile Value (µg/m ³)
2023	8.9	19.3
2024	7.0	17.0
2025	8.5	25.6

⁷ <https://www.epa.gov/air-quality-analysis/exceptional-events-design-value-tool>

Table 1.2 – Current 2023-2025 Gary-Madison Street Annual PM_{2.5} Mean Values

Year	Annual Mean Value (µg/m³)	24-Hour 98th Percentile Value (µg/m³)
2023	9.1	17.5
2024	8.6	18.3
2025	9.5	29.2

Table 1.3 – Current 2023-2025 East- Chicago-Marina Annual PM_{2.5} Mean Values

Year	Annual Mean Value (µg/m³)	24-Hour 98th Percentile Value (µg/m³)
2023	10.5	25
2024	7.9	18.1
2025	8.9	28.3

Table 1.4 – Current 2023-2025 Hammond- 167th Street Annual PM_{2.5} Mean Values

Year	Annual Mean Value (µg/m³)	24-Hour 98th Percentile Value (µg/m³)
2023	10.1	26.1
2024	7.7	17.2
2025	9.4	30.1

IDEM has identified two days, July 31, 2025, and August 5, 2025, for the Gary-Madison St (180890031), East Chicago-Marina (180890034), and Hammond-167th St (180890036) monitors that, if excluded from the 2023-2025 three-year PM_{2.5} design value calculation, would result in a design value for all Lake County monitors below the 2024 PM_{2.5} NAAQS. These days are PM_{2.5} Tier 1 category days according to the U.S. EPA PM_{2.5} Tiering Tool⁸, and they rank as some of the highest observed concentration days at this monitor in the 2021-2025 period. Table 1.5 lists the PM_{2.5} Exceptional Event requested days at each monitor for 2025.

⁸ <https://www.epa.gov/air-quality-analysis/pm25-tiering-tool-exceptional-events-analysis>

Table 1.5 PM_{2.5} - Requested Exceptional Event Exclusion Days

AQS SITE Name	Exceptional Event Days	24-Hour Mean PM_{2.5} Concentration (µg/m³)	5-year Rank	Tier Day	Tier 1 Threshold	Tier 2 Threshold
East Chicago	7/31/2025	60.6	3	1	27	18
Hammond	7/31/2025	61.5	3	1	24.3	16.2
Gary-Madison St	8/5/2025	31.0	2	1	24	16
East Chicago	8/5/2025	29	18	1	27	18
Hammond	8/5/2025	32.1	12	1	24.3	16.2

The East Chicago-Franklin monitor is below the 2024 annual primary PM_{2.5} NAAQS with and without the requested smoke influenced days. By excluding the Tier 1 days at Gary-Madison St (180890031), East Chicago-Marina (180890034), and Hammond-167th St (180890036), the 2023-2025 design value for each attains the 9.0 µg/m³ standard. The Gary-Madison St (180890031), East Chicago-Marina (180890034), and Hammond-167th St (180890036) monitors are the controlling PM_{2.5} monitors for Lake County, IN (their design values are the same). Excluding the data from the days where smoke was present has regulatory significance as the 2023–2025 design value drops below the 2024 annual primary PM_{2.5} NAAQS and will preclude the Lake County, IN from being designated as a nonattainment area for the 2024 annual PM_{2.5} NAAQS. Tables 1.6 through 1.9 provide the 2023-2025 design values for the four Lake County monitors, with and without fire smoke days.

Table 1.6 - Annual PM_{2.5} 3-year Design Values at East Chicago-Franklin, With and Without the Fire Smoke Days

Metric	East Chicago-Franklin Annual Average PM_{2.5} DV (µg/m³)
2023-2025 DV	8.1
2023-2025 DV with requested days removed	8.1

Table 1.7 - Annual PM_{2.5} 3-year Design Values at Gary- Madison Street, With and Without the Fire Smoke Days

Metric	Gary-Madison Street Annual Average PM_{2.5} DV (µg/m³)
2023-2025 DV	9.1
2023-2025 DV with requested days removed	9.0

Table 1.8 - Annual PM_{2.5} 3-year Design Values at East Chicago-Marina, With and Without the Fire Smoke Days

Metric	East Chicago-Marina Annual Average PM_{2.5} DV (µg/m³)
2023-2025 DV	9.1
2023-2025 DV with requested days removed	9.0

Table 1.9 - Annual PM_{2.5} 3-year Design Values at Hammond-167th Street, With and Without Fire Smoke Days

Metric	Hammond-167th Street Annual Average PM_{2.5} DV (µg/m³)
2023-2025 DV	9.1
2023-2025 DV with requested days removed	9.0

2.0 Exceptional Events Elements Overview – Lake County Demonstration

The Exceptional Events Rule requires that demonstrations include a narrative conceptual model describing events that led to PM_{2.5} concentrations being significantly impacted by wildfire smoke, fireworks and other smoke-related events. Information presented in this and the following sections of this demonstration will describe the 2025 Canadian wildfires that adversely affected public health and impacted air quality monitors across Indiana in 2025. The information includes the general meteorological conditions that supported the transport of wildfire smoke from these regions to Indiana. The higher PM_{2.5} concentrations from these wildfires contributed to an exceedance of the annual PM_{2.5} National Ambient Air Quality Standard (NAAQS), have regulatory significance, and should therefore be excluded from regulatory determinations. For this demonstration, IDEM has followed guidance in U.S. EPA's *PM_{2.5} Wildland Fire Exceptional Events Tiering Document* and the Exceptional Events Rule to fully address all required elements, as follows:

- 1) A narrative conceptual model is presented describing the event(s) causing the exceedance or violation at the affected monitors and how two smoke-driven PM_{2.5} episodes in 2025 in the Lake County area led to the annual PM_{2.5} design value exceeding the 2024 revised annual PM_{2.5} NAAQS.
- 2) A clear causal relationship is shown between the specific events and the monitored exceedances or violations, through the presentation of historical data as well as other analyses that correlate the influence of smoke at the monitor(s). This weight-of-evidence conclusion that Indiana has used for its demonstration, as laid out in *PM_{2.5} Wildland Fire Exceptional Events Tiering Document*, includes:
 - Temporal patterns of PM_{2.5} during the event;
 - Ground-level measurements of corroborating pollutant concentrations;
 - National Weather Service and Canadian Fire reports;
 - Smoke forecast models; and,
 - Trajectory (forward and backward) analyses.
- 3) An analysis is provided comparing the claimed event-influenced concentration(s) to concentrations at the same monitoring site at other times, including information and results from U.S. EPA's data visualization and comparison tools to demonstrate smoke influence on PM_{2.5} concentrations at the monitor.
- 4) IDEM has examined whether events were not reasonably controllable and not reasonably preventable, demonstrating that each event impacting the monitoring sites was naturally occurring and therefore neither controllable nor preventable.
- 5) Additionally, IDEM has assessed whether the events were caused by human activity that is unlikely to recur at that particulate location or was a natural event, demonstrating that all events were natural or unlikely to recur.

- 6) Finally, IDEM has fulfilled requirements concerning the public participation process.

2.1 Wildfire Smoke Impacts

Wildfire smoke has played a major role in higher PM_{2.5} concentrations observed throughout the Midwest and especially in Lake County over the past several years. Frequency of wildfires in Canada and the United States have remained fairly consistent over the past several decades, however the acreage burned per year has trended upward with extreme spikes in acreage burned during more recent fire seasons. The resulting wildfire smoke has impacted both ozone and PM_{2.5} concentrations throughout the Midwest. These naturally occurring precursor emissions contribute to the formation of ozone under certain conditions and have elevated PM_{2.5} concentrations beyond what would be expected.

The daily total intensity, indicated by Fire Radiative Power (FRP) values, in Saskatchewan, Manitoba, and Ontario were significantly above the 23-year average throughout June and July of 2025, with correspondingly high estimated wildfire emissions in the three provinces. In Saskatchewan and Manitoba, cumulative wildfire carbon emissions since the start of the year were already at their highest level on record at just over 66 megatons and around 44 megatons respectively, contributing to the cumulative total for Canada of around 180 megatons.⁹

⁹ <https://atmosphere.copernicus.eu/cams-tracks-extreme-july-wildfire-activity-both-sides-atlantic>

Figure 2.1 shows the solid red line for 2025 increasing emissions throughout June.

Figure 2.1 Cumulative Daily Total Wildfire Carbon Emissions

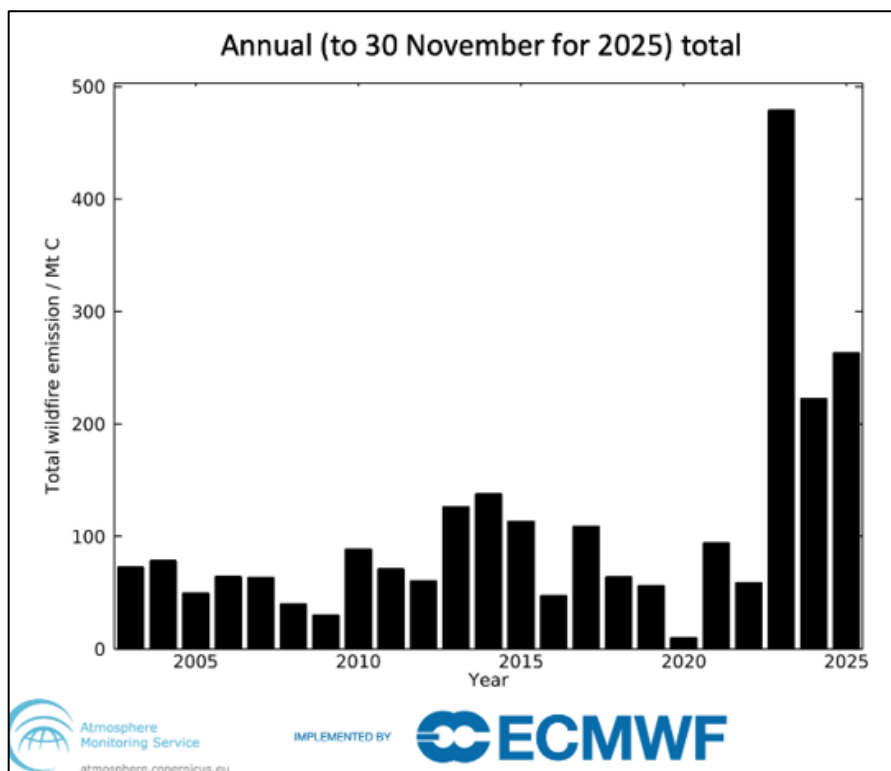
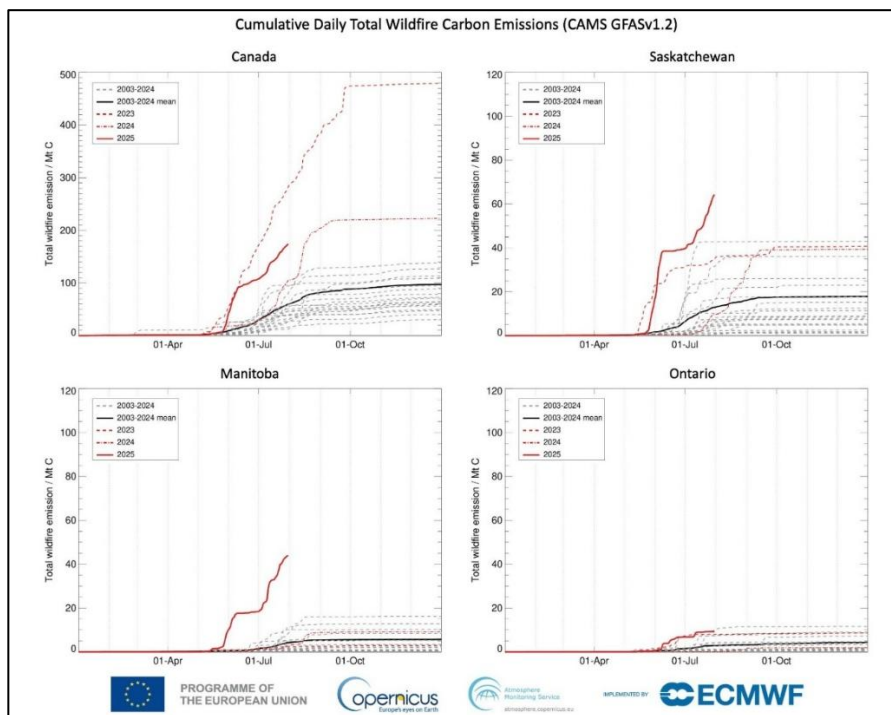
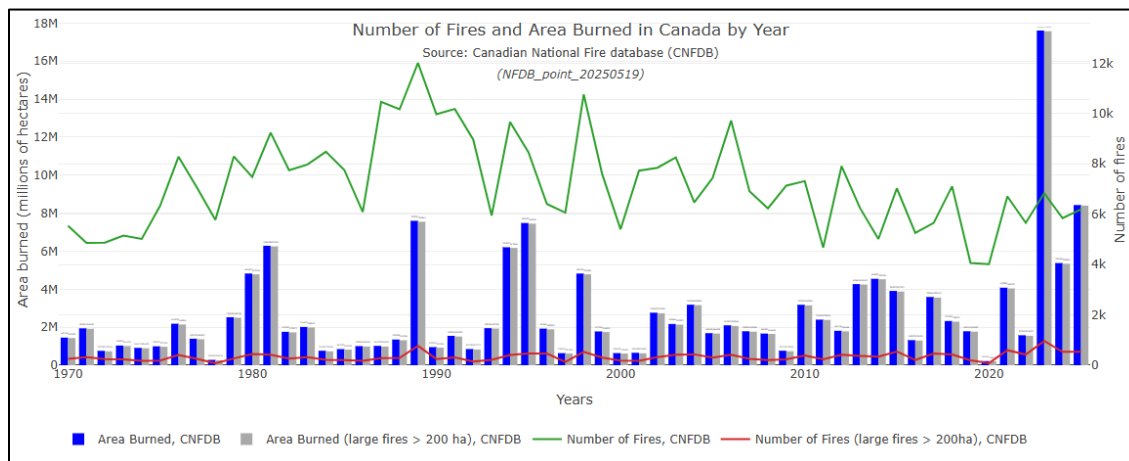


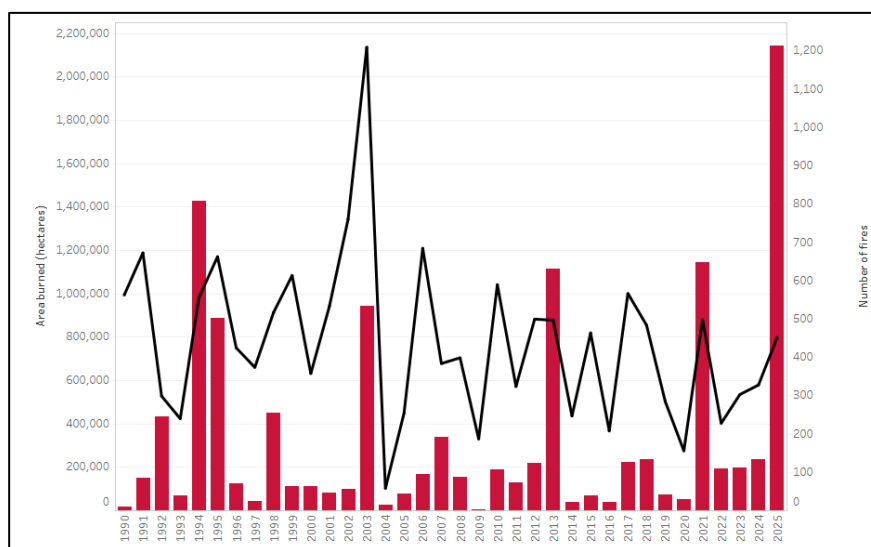
Figure 2.2 depicts the number of wildfires and acreage burned in Canada from 1970 through 2025. 2025 was the second worst wildfire season in Canadian history, with more than 6,000 wildfires in nearly every province and territory, impacting communities across the country and burning over 8.9 million hectares. Wildfires impacted parts of the country due to hot and dry weather. Since April, the heightened risk and impacts have forced evacuations of more than 85,000 people, including over 45,000 people from 73 First Nations communities.¹⁰

Figure 2.2 Canadian Wildfire and Areas (Hectares) Burned (1970 – 2025)



The 2025 wildfire season in Manitoba burned the most hectares since 1990, with almost 2,200,000 hectares burned. Figure 2.3 shows the 1990-2025 Manitoba wildfire statistics.

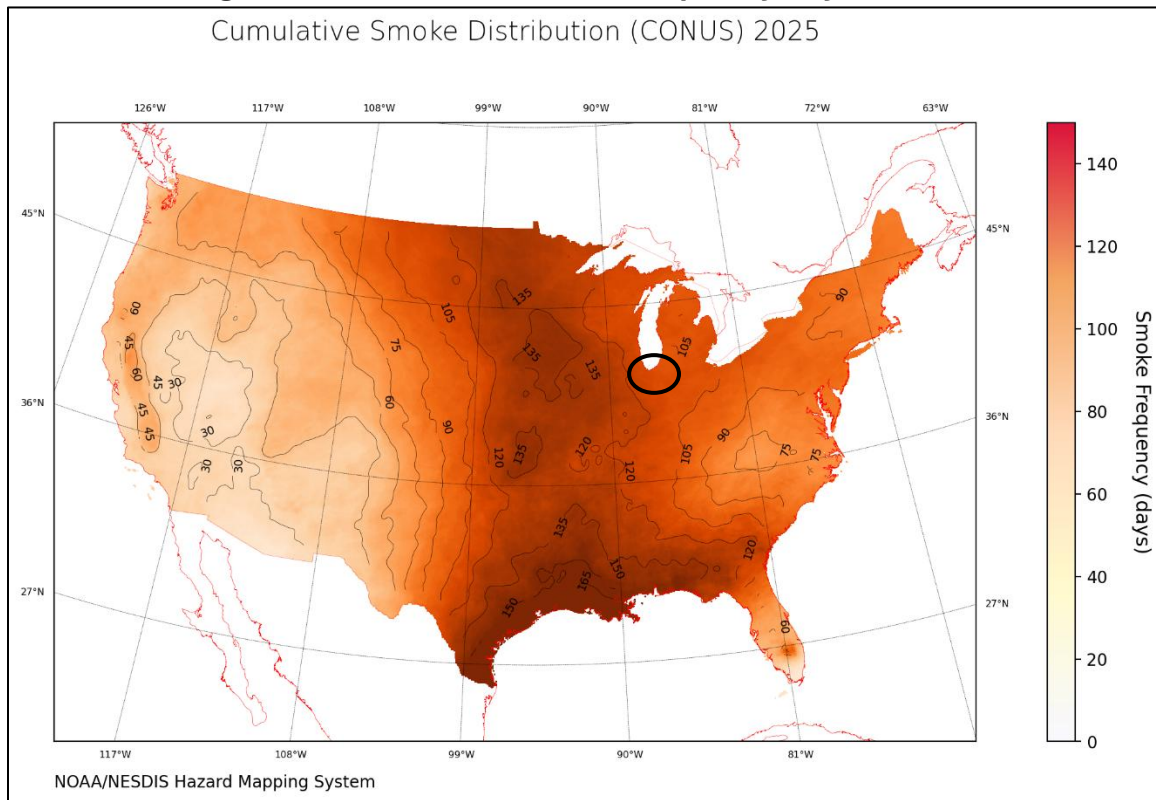
Figure 2.3 Manitoba Wildfire Statistics



¹⁰ <https://www.canada.ca/en/public-safety-canada/news/2025/10/government-of-canada-provides-update-on-2025-wildfires-as-support-continues.html>

The cumulative smoke distribution maps, taken from the NOAA Hazard Mapping¹¹ system fire point analysis, show Lake County, in 2025, had between 105 and 120 smoke frequency days. Figure 2.4 represents the smoke day distribution for the entire country for 2025, with the majority of smoke days concentrated as a result of the severe wildfire season Canada over the Central Plains and Mississippi Valley during 2025.

Figure 2.4 Cumulative Smoke Frequency Days for 2025



¹¹ <https://www.ospo.noaa.gov/products/land/hms.html#stats-smoke>

3.0 Clear Causal Relationship between Event and Monitored Data

As stated earlier, events in this demonstration include July 31, 2025, and August 5, 2025. Each piece of evidence for the two dates demonstrates a clear causal link between transported wildfire smoke and elevated PM_{2.5} concentrations at Lake County monitors. Each event analysis applies the same evidence-based framework to each specific exceedance event. The analytical methods, meteorological analysis, pollutant comparisons, satellite observations, statistical modeling, and trajectory assessments presented in the following sections collectively support the identification of each PM_{2.5} exceedance as an exceptional event influenced by Canadian wildfire smoke.

3.1 Analysis Description for Clear Causal Evidence

IDEM used the following items to prove clear causal relation between wildfire smoke and increased PM_{2.5} concentrations on the requested days for exclusion:

- **Meteorological Overview**
 - This data includes IDEM's summary for the days on and around the days requested for exclusion, with surface, 500mb and 850 mb maps.
- **Comparison with other pollutants**
 - IDEM compared the PM_{2.5} concentration with the nearest monitors for PM_{2.5}. Black Carbon (BC) and UV Carbon (UV) were compared to the five-year average daily concentration. Organic and Black carbon were above the 90th percentile of the five-year average concentrations.¹²
- **MODIS AOD Satellite Imagery**
 - Aerosol Optical Depth (AOD) from the Moderate Resolution Imaging Spectroradiometer (MODIS) combined Terra and Aqua Multi-Angle Implementation of Atmospheric Correction (MAIAC) Land Aerosol Optical Depth level 2 product. An optical thickness of less than 0.1 (palest yellow) indicates a crystal-clear sky with maximum visibility, whereas a value of 1 (reddish brown) indicates very hazy conditions.
- **NOAA GOES Satellite Imagery**
 - Including NOAA text narrative of satellite imagery.
- **AIRNOW PM_{2.5} daily concentrations**
 - U.S. EPA's AirNow Air Quality and Fire and Smoke maps provide a variety of fire- and smoke-related information including air quality data from

¹² See PowerPoint Presentation: Observations of Anomalously High Black Carbon Mass Absorption Coefficients in Fresh Smoke Plumes from Wildfires
(https://insidecires.colorado.edu/rendezvous/uploads/Rendezvous_2020_4833_1597270463.pdf)

permanent and temporary monitors operated by air quality agencies as well as fire locations, smoke plume locations and smoke forecast outlooks.

- **Smokelyze/GAM Modeling Analysis**

- General Additive Modeling (GAM) is a statistical or machine learning framework that provides interpretability by applying smoothing functions to individual variables. Notably, GAMs can incorporate linear, nonlinear, and categorical predictors, providing flexibility for modeling complex relationships¹³. In particular, such statistical/machine learning models can provide an efficient tool for analyzing air quality, especially in relation to wildfire smoke. The PM_{2.5}-criteria is a site-specific threshold used to distinguish background "normal" PM_{2.5} from smoke-influenced elevated concentrations. This methodology has evolved to improve robustness against outliers and eliminate abrupt step-changes between adjacent calendar months.¹⁴ This study demonstrated the importance of wildfire smoke as a contributor to exceedances of the health-based national air quality standards for PM_{2.5}.

- **HYSPLIT Back Trajectory Analysis**

- HYSPLIT is an atmospheric transport and dispersion model developed by the National Oceanic and Atmospheric Administration (NOAA) Air Resources Laboratory (ARL) to compute air-parcel trajectories and simulate the dispersion, transport, and deposition of gases and particles from local to global scales. Using gridded meteorological data, it can run forward or backward in time, handle multiple emissions scenarios, and account for processes such as turbulence, wet and dry deposition, simple decay, and limited chemistry. Outputs include air-parcel trajectories, concentration and deposition fields, and source "footprints," supporting applications such as emergency response to hazardous releases, volcanic ash forecasting, wildfire smoke and dust tracking, nuclear/radiological assessments, and research on long-range pollutant transport

This tool provides 5-day backward air parcel trajectories from all active monitors for ozone, fine particulate matter (PM_{2.5}), particles with diameters less than 10 microns (PM₁₀), and sulfur dioxide (SO₂), covering 2023 through the most current design value year. For any selected monitoring site and date, the tool returns four trajectories corresponding to parcel arrival times at 00:00, 06:00, 12:00, and 18:00. These four times enable users to capture shifts in the diurnal cycle due to local meteorology and transport that can

¹³ Wood, S.N. (2017). Generalized Additive Models: An Introduction with R, Second Edition (2nd ed.). Chapman and Hall/CRC. <https://doi.org/10.1201/9781315370279>

¹⁴ Lee, H., and Jaffe, D. A. (2026). Smokelyze.org: Advanced Spatiotemporal Analytics for Wildfire Smoke and Air Quality (v1.0.0) [Software]. University of Washington. <https://doi.org/10.5281/zenodo.22239823>

influence measured concentrations. Each trajectory is analyzed to determine spatial intercepts with NOAA's Hazardous Mapping System (HMS) smoke polygons, helping identify when transported smoke may have influenced conditions at the monitoring site. An "intercept" indicates a spatial overlap between the trajectory and an HMS smoke polygon, but it is not conclusive evidence that the air parcel traveled through the smoke plume. HMS classifies smoke plume density as heavy, medium, or light. This tool only considers heavy and medium smoke plume density.¹⁵

- **HRRR Model**

- To support the veracity and reliability of the smoke attribution in this Exceptional Events Analysis, NOAA's High-Resolution Rapid Refresh (HRRR) and Rapid Refresh (RAP) modeling systems were evaluated. The HRRR is a 3 km, hourly updated, cloud-resolving model that incorporates 3 km radar assimilation every 15 minutes. This provides higher-resolution detail relative to the 13 km RAP system, which supplies the continental-scale, hourly updated analysis and model fields used to initialize HRRR.

3.2 July 31, 2025, PM_{2.5} Event

3.2.1 Episode Description

On July 31, 2025, Northwest Indiana experienced elevated PM_{2.5} concentrations at Lake County monitors, with values ranging from 60-61 µg/m³, surpassing the 35 µg/m³ 24-hour PM_{2.5} NAAQS and the Tier 1 threshold at the East Chicago-Marina (180890034) and Hammond-167th St (180890036) monitors. Multiple lines of evidence confirm that Canadian wildfire smoke was a key contributor for the Tier 1 Day:

- Meteorological conditions on July 31 supported long-range smoke transport into Lake County. Synoptic patterns produced sustained northerly to northwesterly flow, allowing smoke from large Canadian wildfires to move southward across the Great Lakes.
- Satellite Imagery & AOD Analysis: Dense smoke plumes from Canadian Wildfire regions are visible.
- Air Quality Indicators: AirNow maps showed elevated PM_{2.5} concentrations coinciding with smoke presence.
- Modeling Support: GAM analyses estimate up to 52 µg/m³ of PM_{2.5} attributable to wildfire smoke.
- Trajectory Analysis: HYSPLIT back trajectories link air masses directly to the EA061 Fire, Manitoba.

¹⁵ <https://www.epa.gov/system/files/documents/2026-06/hysplit-overview-and-configuration.pdf>

This convergence of observational data, satellite imagery, and modeling establishes a clear causal relationship between wildfire smoke and PM_{2.5} exceedances. These findings support classification of July 31, 2025, as an exceptional event under U.S. EPA guidelines.

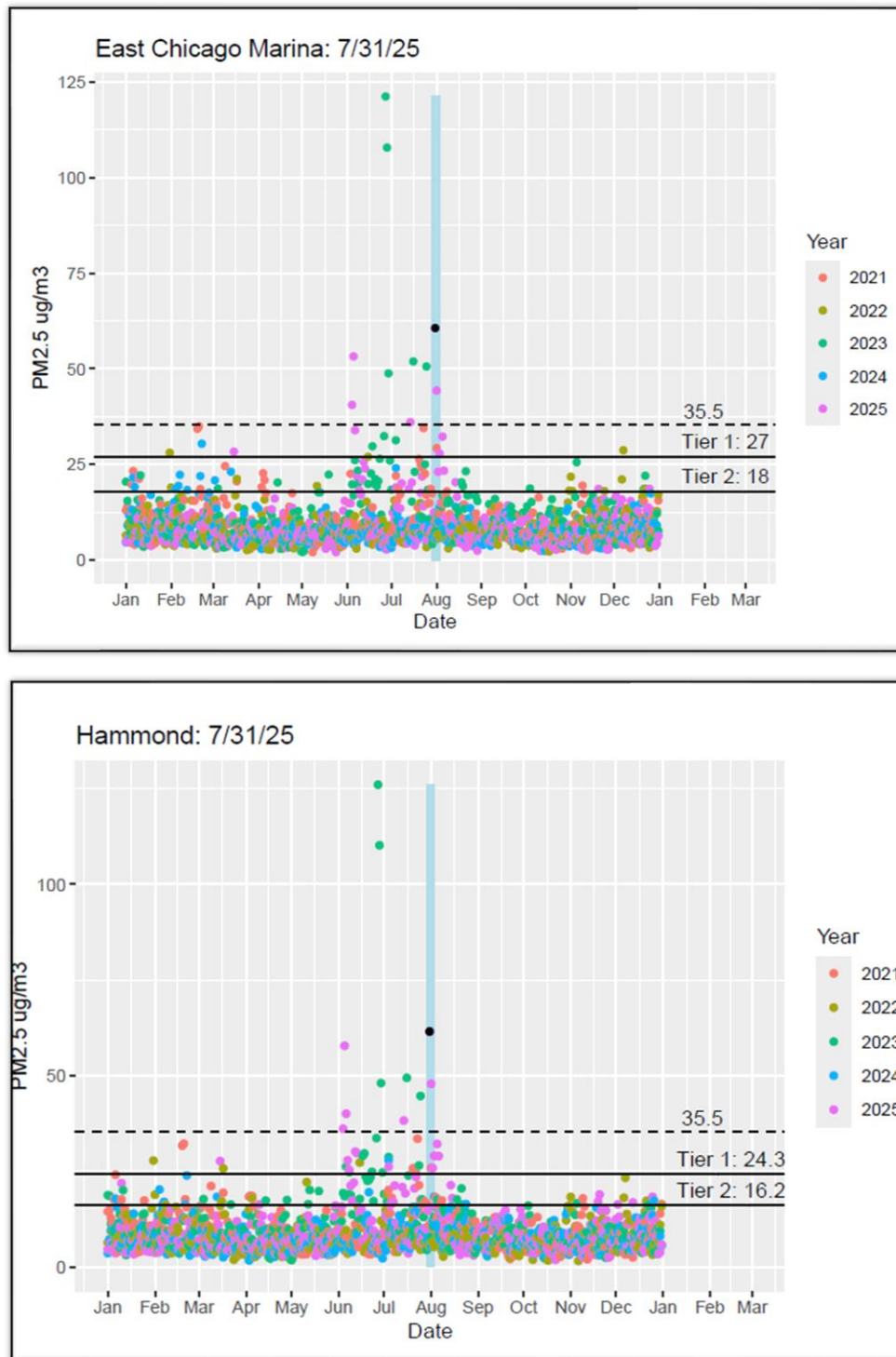
Table 3.2.1 shows the daily PM_{2.5} data from the East Chicago-Marina and Hammond-167th Street for July 31, 2025. The table shows the 5-year rank among all daily PM_{2.5} concentrations as well as the U.S. EPA Tier 1 and Tier 2 thresholds at the monitors.

Table 3.2.1- Exceptional Event PM_{2.5} Concentrations (µg/m³) at Lake County Monitors

AQS SITE NAME	Exceptional Event Days	24-Hour Mean PM_{2.5} Concentration (µg/m³)	5-year Rank	Tier Day	Tier 1 Threshold	Tier 2 Threshold
East Chicago-Marina	7/31/2025	60.6	3	1	27	18
Hammond-167 th Street	7/31/2025	61.5	3	1	24.3	16.2

Figure 3.2.1 displays daily average PM_{2.5} concentrations for the years 2021 – 2025 at the Lake County PM_{2.5} monitors. This plot shows the average 24-hour PM_{2.5} concentration by year on each day. The figure illustrates the increased PM_{2.5} concentrations relative to other periods of the year and compared to the same period in the past five years as a result of smoke impacts. July 31, 2025, is highlighted in blue and marked with a black dot.

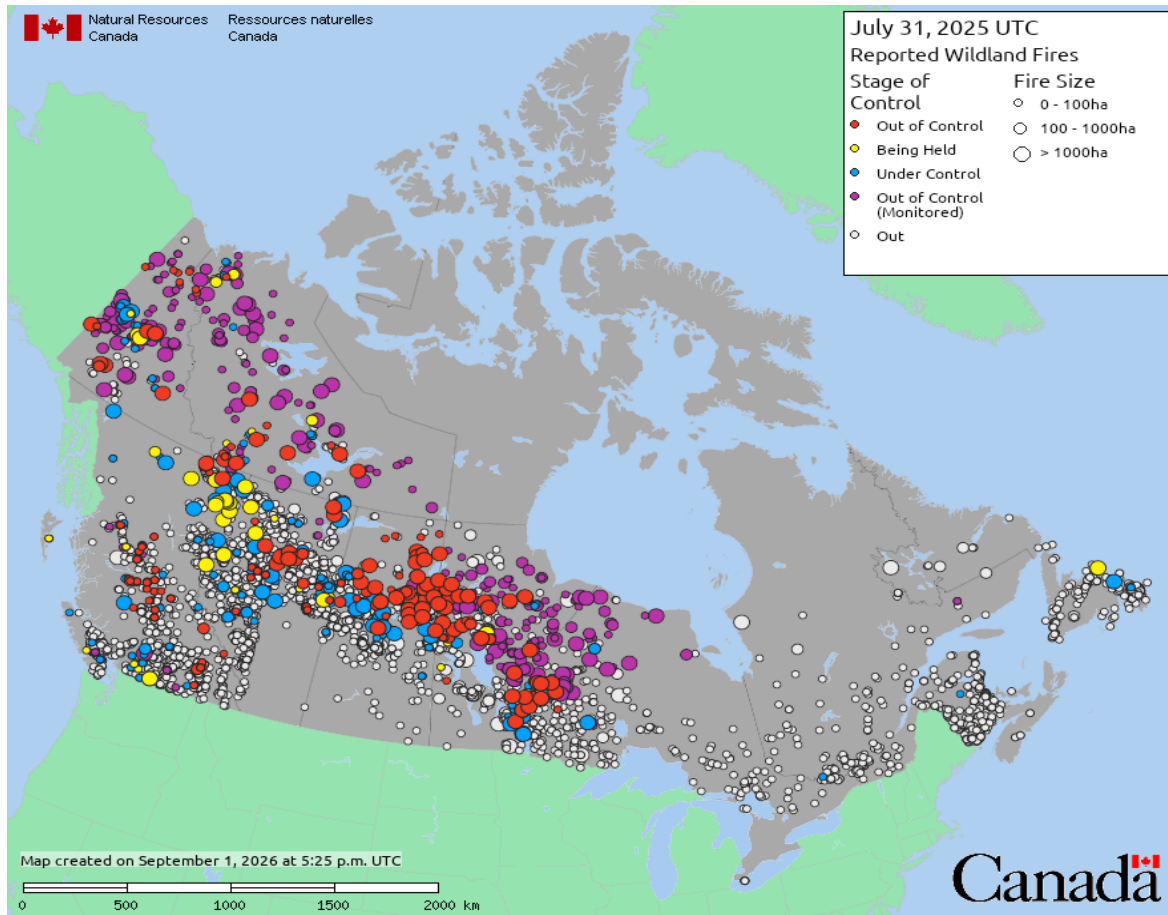
Figure 3.2.1 - Daily Average PM_{2.5} Concentrations at Lake County Monitors



3.2.2 Active Wildland Fires

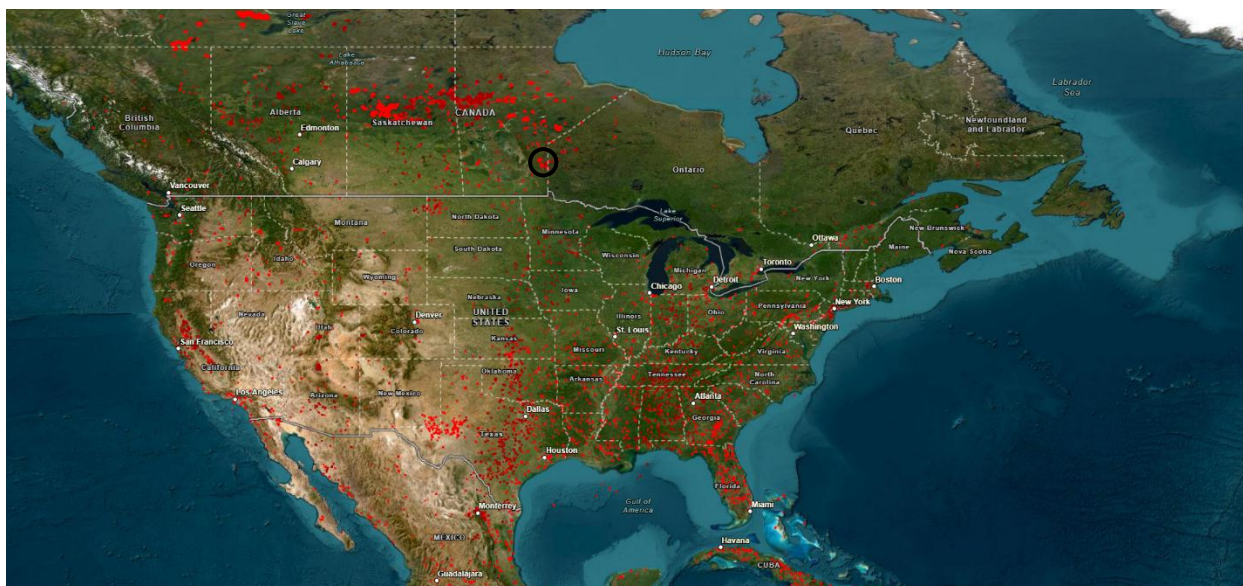
Figure 3.2.2 displays the active wildfires for July 31, 2025, from The Canadian Wildland Fire Information System¹⁶ and NASA LANCE FIRMS US/Canada¹⁷.

Figure 3.2.2 Active Canadian Wildfire-July 31, 2025



¹⁶ <https://cwfis.cfs.nrcan.gc.ca/en/>

¹⁷ https://firms.modaps.eosdis.nasa.gov/usfs/map/#d:2022-03-13..2022-03-15;l:fires_all,fire-perimeter,countries,earth;@-87.0,36.3,6.2z



Fire EA061, circled on the map above, remains out of control at approximately 373,127 ha. This is a fire that was one of many that created the wildland fire smoke in Lake County. The fire started by lightning on May 12, 2025 and was declared under control September 24 and officially out on December 19, 2025.¹⁸

3.2.3 Meteorological Episode Overview

July 31, 2025 conditions:

Today's synoptic setup features a cold front draped along the Ohio River this morning, as depicted on the 4:45 AM frontal position map. An area of low pressure centered over northern Kentucky, with a trailing trough extending northwestward, is producing widespread rain and embedded thunderstorms across all of Indiana. Northerly surface winds have ushered in overcast skies, with the heaviest downpours currently confined to central Indiana and counties to the south. Meanwhile, a 1028 mb surface high over Minnesota is sliding southward into the Upper Midwest, tightening the pressure gradient and generating gusty northeast winds across Indiana. According to NOAA's WPC fronts and NDFD weather-type guidance for 12 Z and 00 Z today, clearing will occur progressively from north to south as drier air filters in behind the front. Upper-air forecasts from the NAM at 250 mb and 500 mb show the mid-level flow veering northwest over the state, ushering a cooler airmass into the Great Lakes region. Temperatures at 850 mb this afternoon are progged between 10 °C across northern Indiana and 18 °C in southern zones, with northeast flow prevailing at both the surface and 850 mb levels.

Wildfire Updates:

Smoke from Canadian wildfires will spread into northern Indiana today as a cold front pushes southward. Early morning fine particulate readings are in the upper 30's to low 40's already with higher concentrations in Chicago and central Michigan. The NOAA 12 Z BC

¹⁸ https://www.gov.mb.ca/conservation_fire/Fire-Status/2025/EA-061-firestatus.html

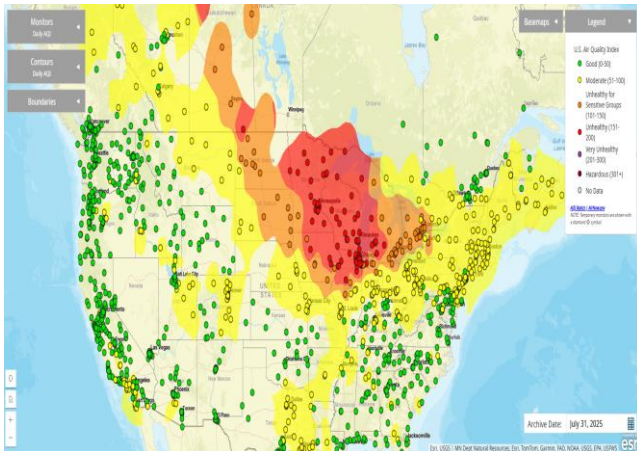
one-hour max $PM_{2.5}$ analysis shows Air Quality Index values in the Unhealthy for Sensitive Groups category over a small area near Michigan City and across Chicago, yet 24-hour averages remain in the moderate range for both today and tomorrow. The NOAA Near-Surface 03 Z forecast indicates surface smoke concentrations generally below $5 \mu\text{g}/\text{m}^3$ despite these localized hourly spikes. The Canadian Wildfire Smoke Fine Particulate Matter 72-hour forecast predicts hourly $PM_{2.5}$ around $30 \mu\text{g}/\text{m}^3$ by midday, rising to $60 \mu\text{g}/\text{m}^3$ or more late this afternoon in northwest Indiana, with somewhat lower levels farther east. The HRRR-NCEP 06 UTC run agrees on timing and placement of the plume but limits smoke-only $PM_{2.5}$ under $20 \mu\text{g}/\text{m}^3$. In addition, levels at 1,000 ft AGL are forecast to be in the $8\text{--}20 \mu\text{g}/\text{m}^3$ range and slightly higher than the surface late today with very low concentrations at 6,000 ft AGL for our northern areas. Meanwhile, NASA's GMAO model shows a narrow near-surface plume pushing across all of northern Indiana late this morning, driving total $PM_{2.5}$ above $100 \mu\text{g}/\text{m}^3$ before northeast winds and clearing skies mix the plume out by early evening; mixing heights are forecast to peak near 3,800 ft. The NWS forecast office in Chicago notes hazy, smoky conditions today across northwest Indiana due to wildfire smoke, with potential for a few lake-effect or enhanced sprinkles later tonight into early Friday which could wash out some smoke particles. They add that north-northeast flow behind the cold front has already spread smoke back into the Great Lakes region—surface visibilities dropped to 3–5 miles across parts of Wisconsin and Michigan yesterday. HRRR near-surface smoke concentrations suggest this plume will rotate south-southwestward into northern Indiana today into Friday, so the forecast maintains a patchy smoke mention and a minimum 25 percent sky cover to account for lingering haze. Tomorrow, all models forecast lower smoke and fine particulate levels as a Canadian high-pressure system settles in. Surface $PM_{2.5}$ should remain in the moderate category into Friday morning before gradually diminishing, with any residual haze expected to clear by late morning or early afternoon. Regional forecasters will address smoke impacts in more detail as part of their analysis.

The Canadian and NOAA 6Z BC models both show moderate $PM_{2.5}$ today, which is consistent with recent measurements. The Canadian model keeps this forecast for tomorrow, while the NOAA 6Z BC model decreases into the good range. The Canadian and NOAA smoke models both show wildfire smoke moving into the region today, though the Canadian shows higher values than the NOAA, with results near $30 \mu\text{g}/\text{m}^3$ as opposed to below $10 \mu\text{g}/\text{m}^3$. The Canadian model is more accurate compared to this morning's $PM_{2.5}$ values, which have risen above $30 \mu\text{g}/\text{m}^3$ at multiple monitors. Given the recent increase in values as wildfire smoke moves into the region this morning, as well as the decreasing rain chances, USG level $PM_{2.5}$ will be possible today in northwest and north central Indiana.

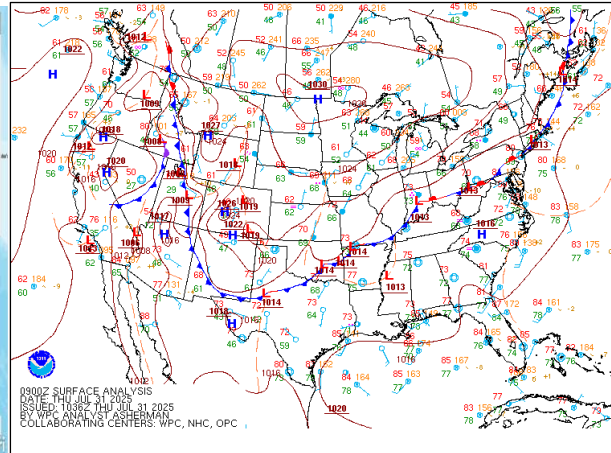
Figure 3.2.3 shows AirNow 24-hour $PM_{2.5}$, surface, 850 mb and 500 mb weather maps, depicting surface and upper air features that enhanced smoke transport into the northwest Indiana area.

Figure 3.2.3 – AirNow, Surface, 850 and 500 mb plots from July 31, 2025

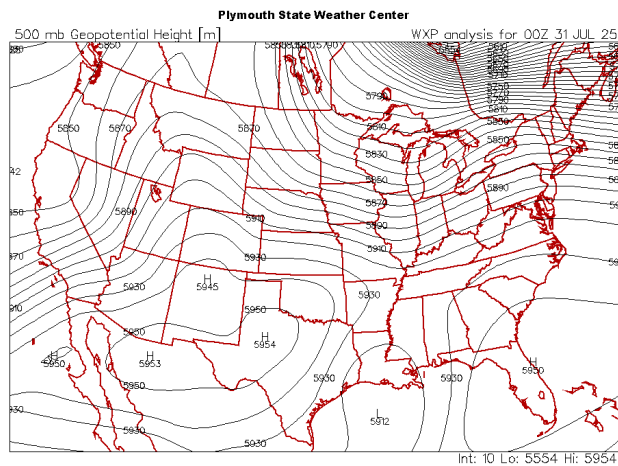
AirNow Tech PM2.5 Map



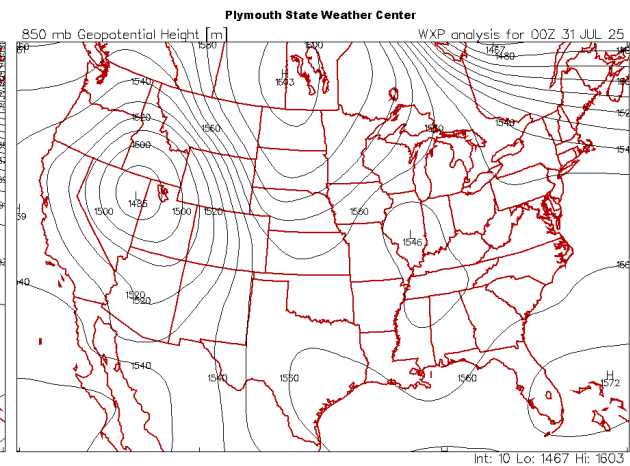
Surface Analysis Map



500 mb Upper Air Analysis Map



850 mb Upper Air Analysis Map

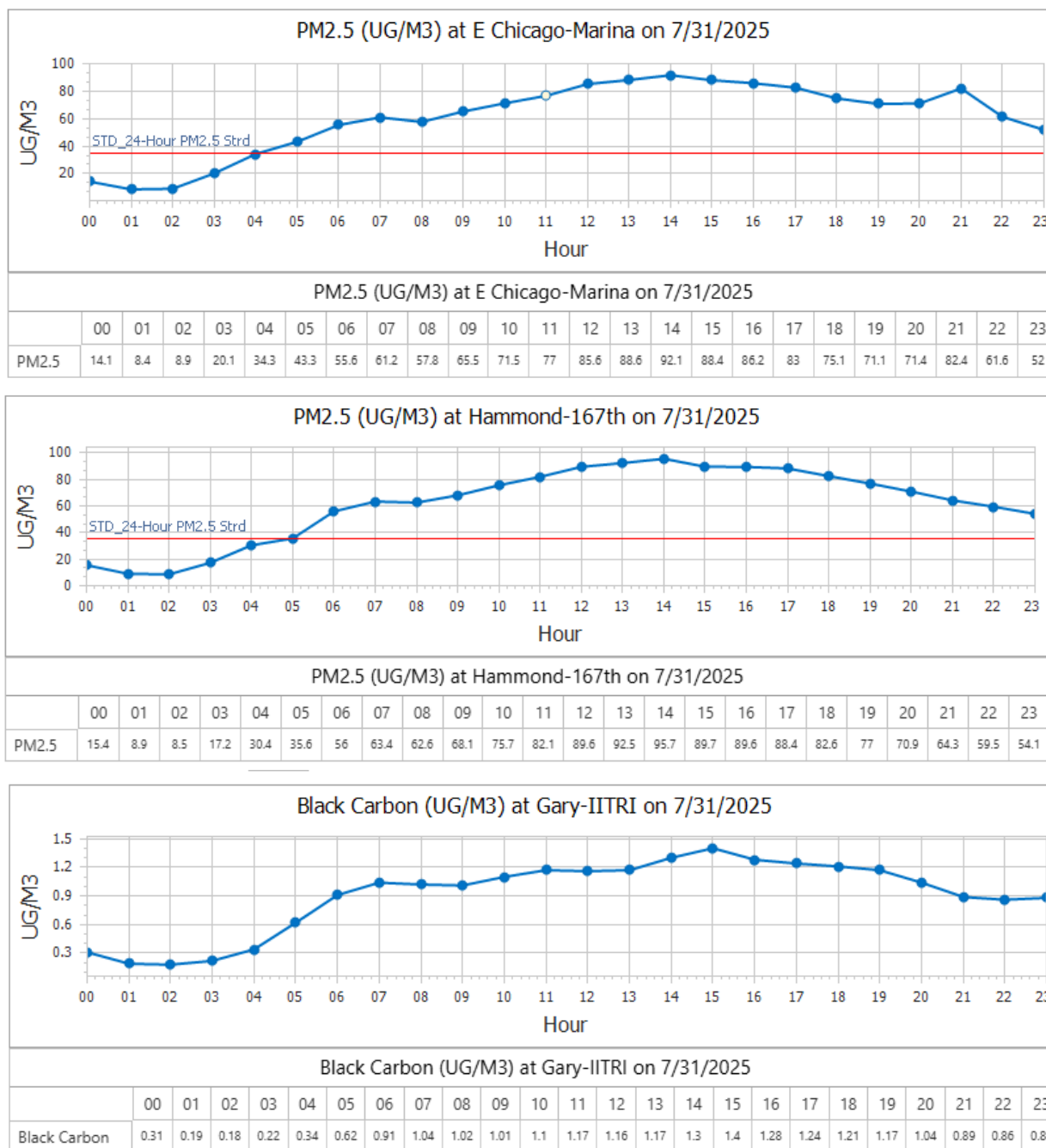


3.2.4 Hourly Monitoring Readings – PM_{2.5} and Speciated Data

In conjunction with the fire and smoke maps, Figure 3.2.4 shows the hourly PM_{2.5} values from the East Chicago-Marina and Hammond 167th Street monitors. The organic and black carbon monitored data was from the Gary-IITRI monitor. This monitor is in Lake County about 20 miles away from the two continuous monitors. Particulate matter is the principal pollutant of concern with wildfire smoke, particularly PM_{2.5} which is far smaller than the diameter of a human hair and can be inhaled deeply into the lungs. PM_{2.5} is a complex mixture of solids and aerosols that can contain a myriad of chemical compounds, including metals, organic and elemental carbon, potassium, organic matter and geologic material, and potentially ammonium nitrate and ammonium sulfate ([Camp Fire Air Quality Data Analysis](#)). Organic carbon (OC) is a known chemical tracer for biomass burning and can help track the influence and intensity of PM_{2.5} wildfire smoke. Black carbon is a product of incomplete combustion and is primarily emitted from vehicles, power plants,

residential heating, and wildfires. IDEM is only listing monitored parameters such as organic and black carbon and not derived parameters, such as brown carbon, which represents the difference between organic and black carbon. The Gary-IITRI organic and black carbon values were elevated with the Lake County PM_{2.5} concentrations of July 31, indicating the regional extent of the smoke.

Figure 3.2.4 - Hourly PM_{2.5} and Black Carbon (BC) and Organic Carbon (UV) Concentrations for July 31, 2025



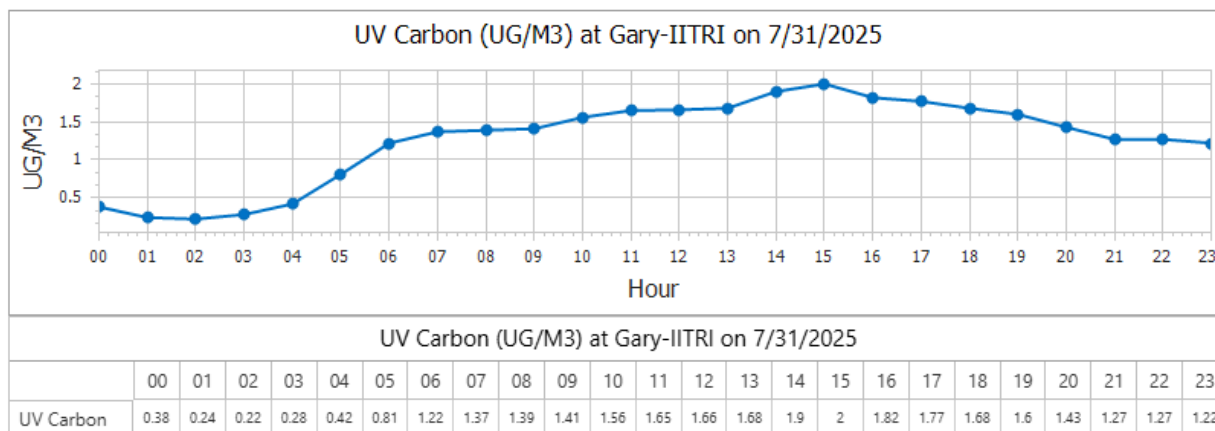
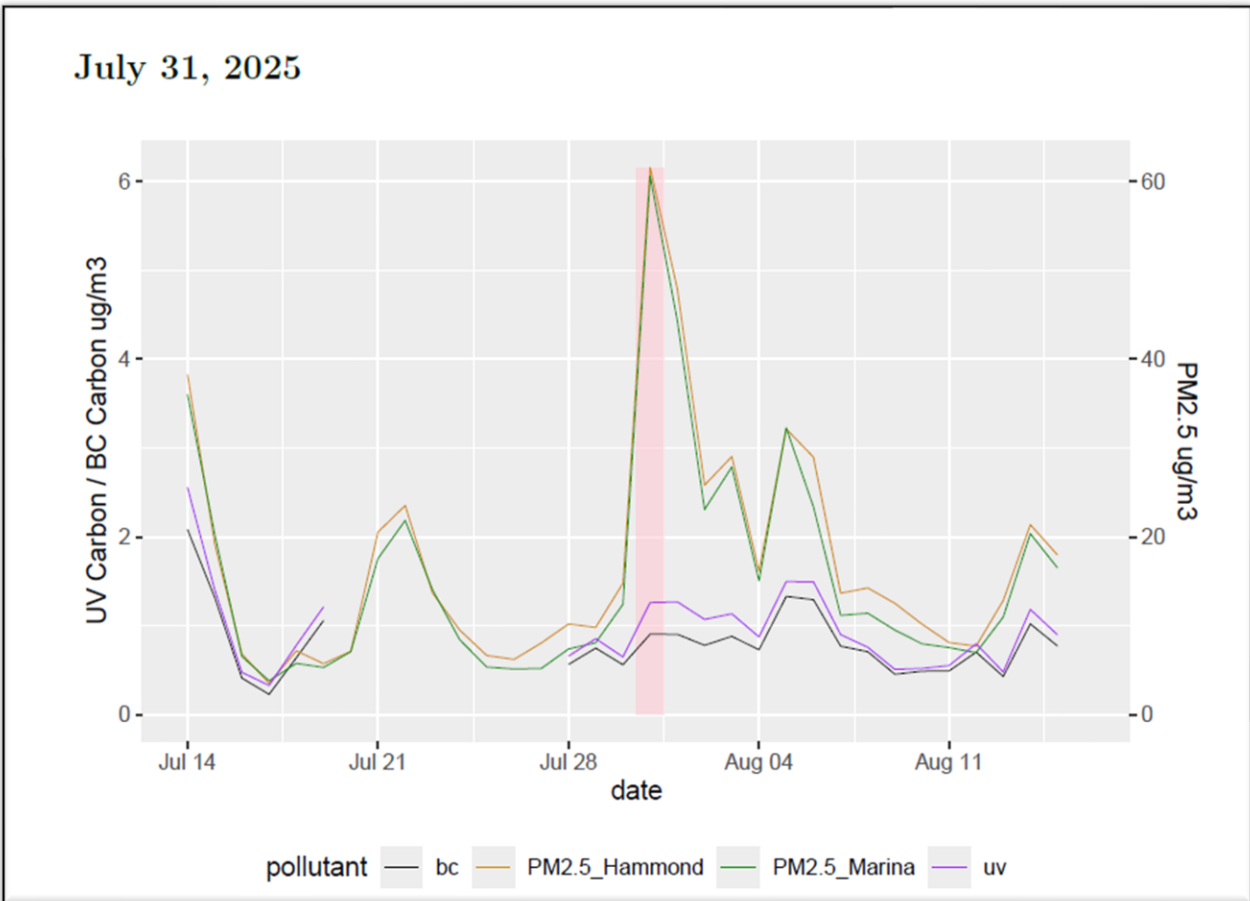


Figure 3.2.5 displays the July/August 2025 OC concentrations measured at the Lake County monitors with July 31 highlighted. Black carbon is the black line, OC is the purple line, both with concentrations on the left axis. East Chicago-Marina PM_{2.5} is the orange line and Hammond-167th Street is the green line, with the concentration on the right axis. As noted by the spike in PM_{2.5}, OC, and BC concentrations during the exceptional event, wildfire smoke impacted the monitor during this time. PM_{2.5} was generally higher during the smoke exceptional event than the average for the two exceptional events during this time period. Both OC and BC daily averages were over the 90th percentile for the five-year period of 2021-2025.

Figure 3.2.5 - Organic and Black Carbon Concentrations for July/August 2025



3.2.5 AOD and Satellite Analyses

Figure 3.2.6 displays satellite imagery from Aerosol Optical Depth (AOD) from the Moderate Resolution Imaging Spectroradiometer (MODIS) combined Terra and Aqua Multi-Angle Implementation of Atmospheric Correction (MAIAC) Land Aerosol Optical Depth level 2 product. An optical thickness of less than 0.1 (palest yellow) indicates a crystal-clear sky with maximum visibility, whereas a value of 1 (reddish brown) indicates very hazy conditions. The dark red color in southern Indiana indicates the presence of smoke.

Figure 3.2.6 Satellite Imagery with MAIAC AOD

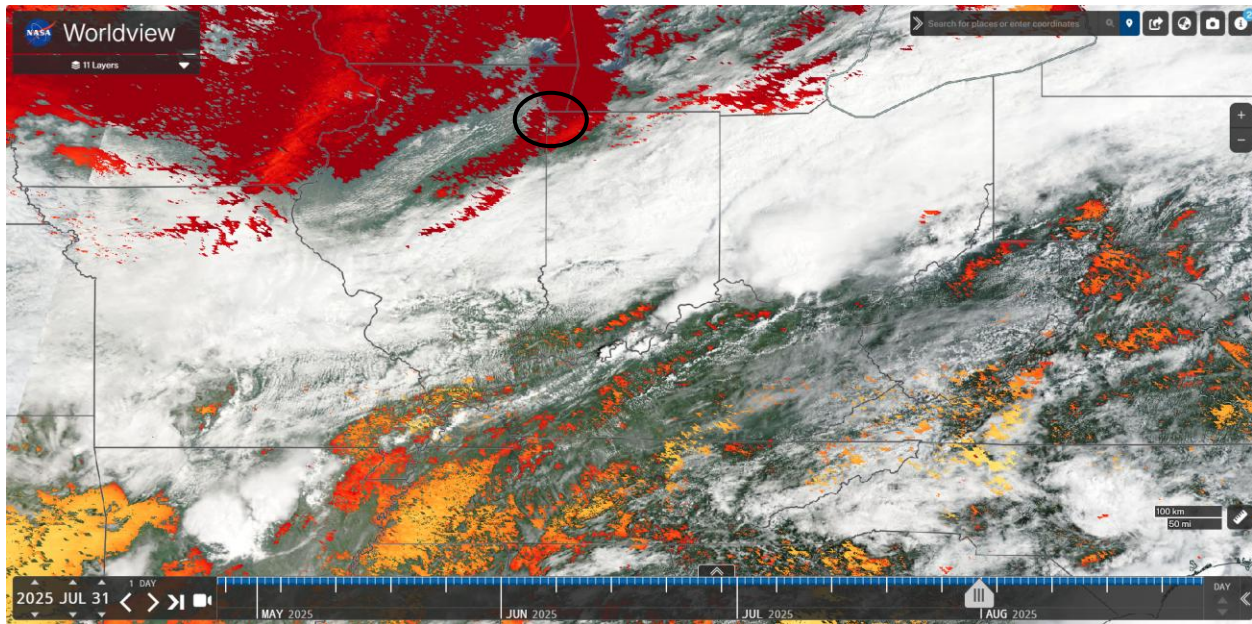
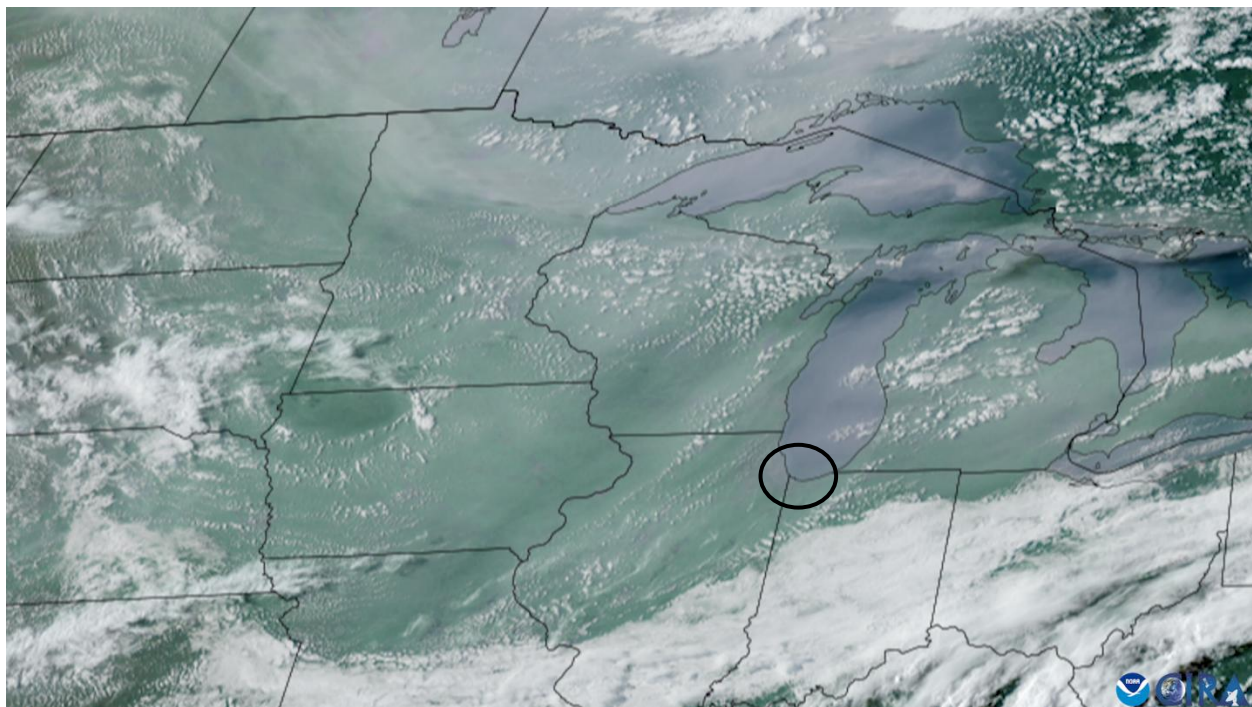
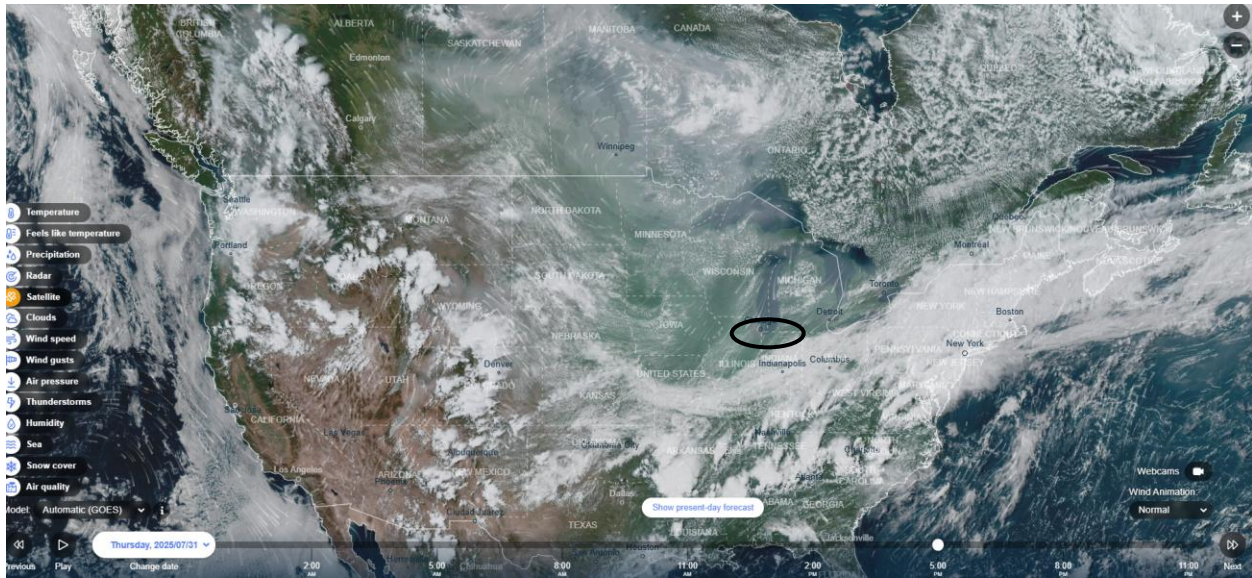


Figure 3.2.7 displays two satellite images indicating Canadian wildfire smoke coming from Manitoba, Saskatchewan, and Alberta. July 31st shows heavy smoke from Canada being pushed by the southerly winds into Lake County.¹⁹

¹⁹ <https://satlib.cira.colostate.edu/event/north-american-wildfires/>

Figure 3.2.7 - Satellite Imagery July 31, 2025



NOAA Satellite Smoke Forecast

DESCRIPTIVE TEXT NARRATIVE FOR SMOKE/DUST OBSERVED IN SATELLITE IMAGERY
THROUGH 0145Z July 31, 2025

SMOKE:

Alaska/Canada/North Atlantic Ocean...

A large area of smoke persisted across the northern region of the

continent, and drifted towards the east from eastern Alaska to the North Atlantic. Wildfires in the Northwest Territories, Saskatchewan and Manitoba continued to produce large, dense plumes of smoke that moved east across Ontario and Quebec, thinning toward the Atlantic.

Arizona/Utah/Central United States...

Wildfires continued to burn in central Utah and northern Arizona, merging with the larger area of smoke produced by the Canadian wildfires as the smoke drifted northeast. Moderate-to-heavy smoke spread over Wyoming, Montana, Colorado, Nebraska, and the northern Great Plains, with moderate density smoke reaching the Great Lakes.

3.2.6 Smokelyze/GAM Modeling Analysis

To identify the presence of smoke in a region, Smokelyze uses the NOAA Hazard Mapping System (HMS) fire and smoke product (Ruminski et al., 2011; Kaulfus et al., 2017; Buysse et al., 2019). It is based on multiple geostationary satellites and gives a smoke density as high, medium or low. However, as the HMS product is derived from satellite data, it does not provide any vertical information on smoke plumes. The previous analysis (Buysse et al., 2019) indicates that enhanced $PM_{2.5}$ at the surface is found on 30-80% of days with an overhead smoke plume, depending on the location. Nevertheless, the HMS smoke product is critical to identify days when regional $PM_{2.5}$ concentrations are possibly influenced by smoke (Kaulfus et al., 2017). Smokelyze defines any location that is within the boundaries of an HMS smoke plume as $HMS=1$ and a site with no overhead smoke as $HMS=0$.²⁰

The $PM_{2.5}$ -criteria is a site-specific threshold used to distinguish background "normal" $PM_{2.5}$ from smoke-influenced elevated concentrations. This methodology has evolved to improve robustness against outliers and eliminate abrupt step-changes between adjacent calendar months.

Methodological Improvement: While Lee and Jaffe (2024a; 2024b) utilized a Mean + Standard Deviation (SD) approach, the Median + Median Absolute Deviation (MAD) method was adopted in Lee and Jaffe (2025) and Jaffe et al. (2026) to better handle extreme values and non-normal distributions.

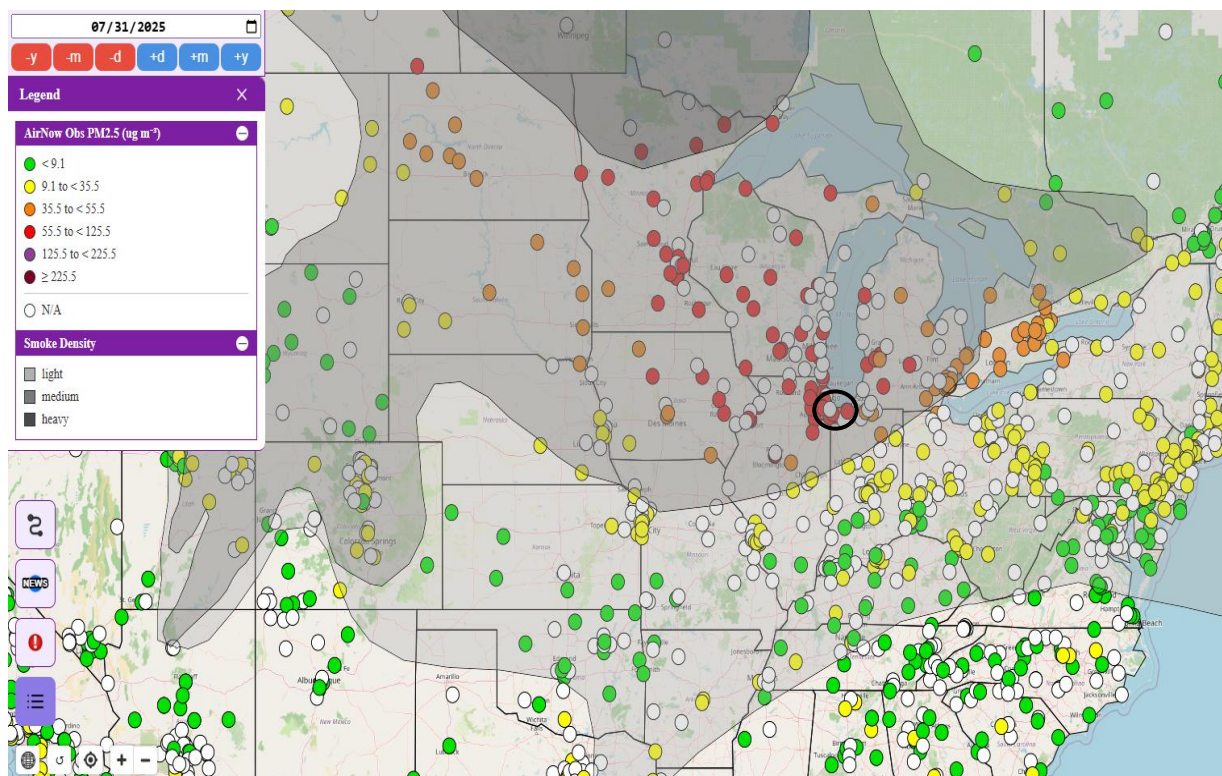
Smokelyze Improvement (5-Yr & 3-Mt Rolling Window): Building upon the Median + MAD foundation from published literature, this web platform adopts a combined 5-year rolling window with a 3-month seasonal rolling window (target month $\pm$ 1 month). This

²⁰ <https://smokelyze.org/resrc/documents/?doc=doc-smoke-impacts>

enhancement directly addresses the growing risk of baseline sample scarcity, caused by increasingly frequent wildfire smoke events reducing the number of non-smoke (HMS = 0) days, while ensuring sample sufficiency ($n \geq 10$) and eliminating artificial step-changes between adjacent months.²¹

Figure 3.2.8 from the Smokelyze app shows the AirNow observed $PM_{2.5}$ concentration for July 31, 2025 with the HMS -Smoke coverage. Table 3.2.2 shows the estimated smoke contribution to the $PM_{2.5}$ concentration.

Figure 3.2.8 Smokelyze Observed $PM_{2.5}$ With HMS-Smoke



²¹ <https://smokelyze.org/resrc/documents/?doc=doc-pmcrit>

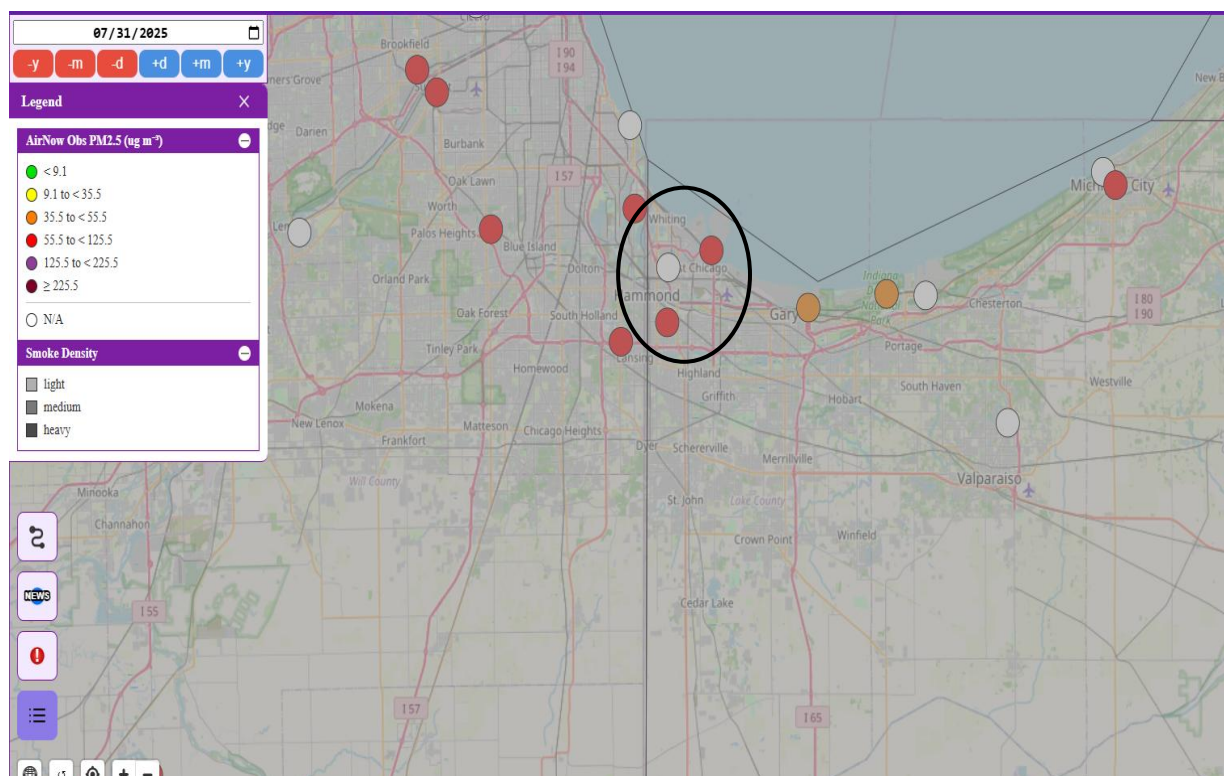


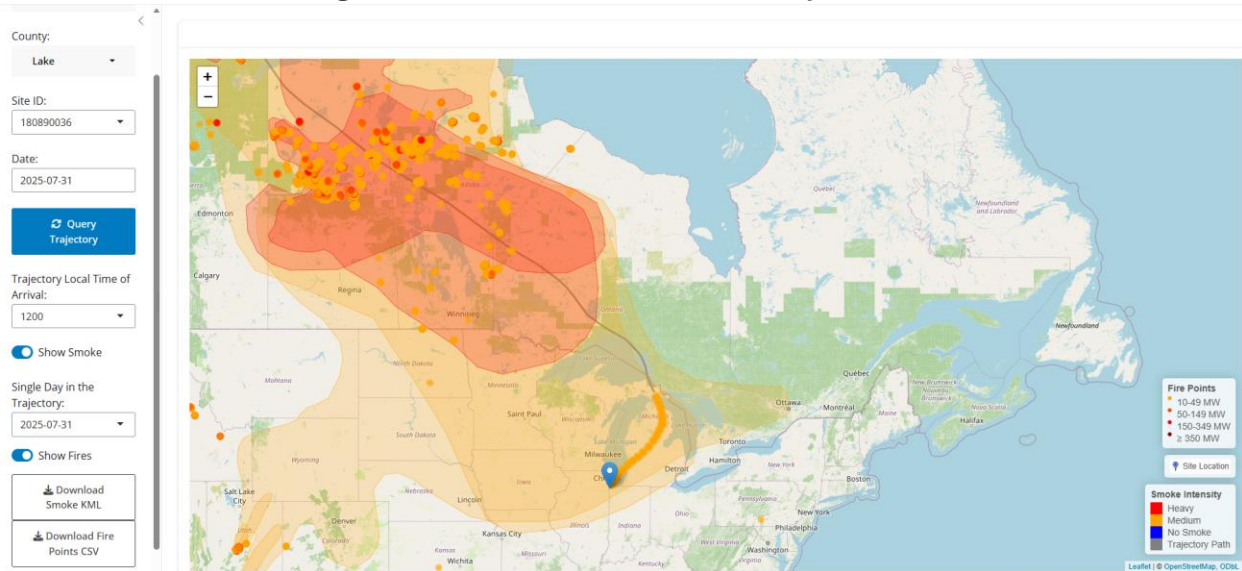
Table 3.2.2 Smokelyze/GAM Estimated Smoke Contribution

Monitor Name	AQS	24-Hour Mean PM _{2.5} Concentration(µg/m ³)	GAM 24-Hour Estimated Smoke Contribution (µg/m ³)
East Chicago - Marina	180890034	60.6	52.8
Hammond-167th St	180890036	61.5	52.9

3.2.7 HYSPLIT Backward Trajectories

HYSPLIT Backward Trajectories provide 5-day backward air parcel trajectories from all active monitors for ozone, fine particulate matter (PM_{2.5}), particles with diameters less than 10 microns (PM₁₀), and sulfur dioxide (SO₂), covering 2023 through the most current design value year. Each trajectory is analyzed to determine spatial intercepts with NOAA's Hazardous Mapping System (HMS) smoke polygons, helping identify when transported smoke may have influenced conditions at the monitoring site. An "intercept" indicates a spatial overlap between the trajectory and an HMS smoke polygon, but it is not conclusive evidence that the air parcel traveled through the smoke plume. HMS classifies smoke plume density as heavy, medium, or light. This tool only considers heavy and medium smoke plume density. Figure 3.2.9 shows the backward trajectory from Hammond-167th St on July 31st going north through heavy smoke regions in central Canada.

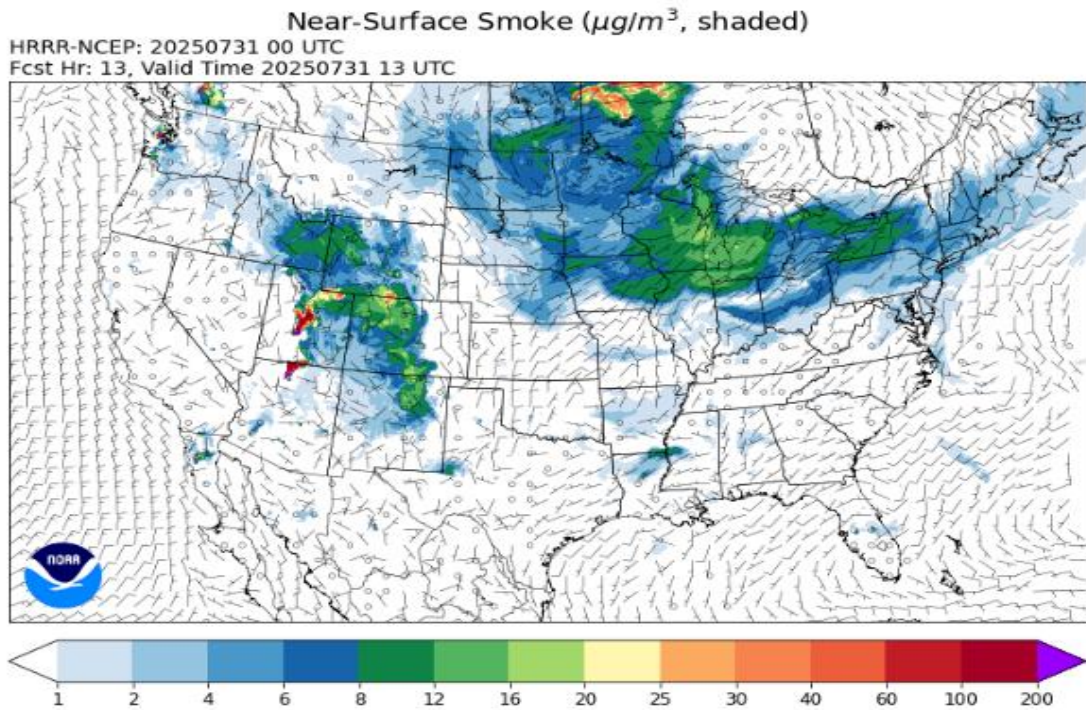
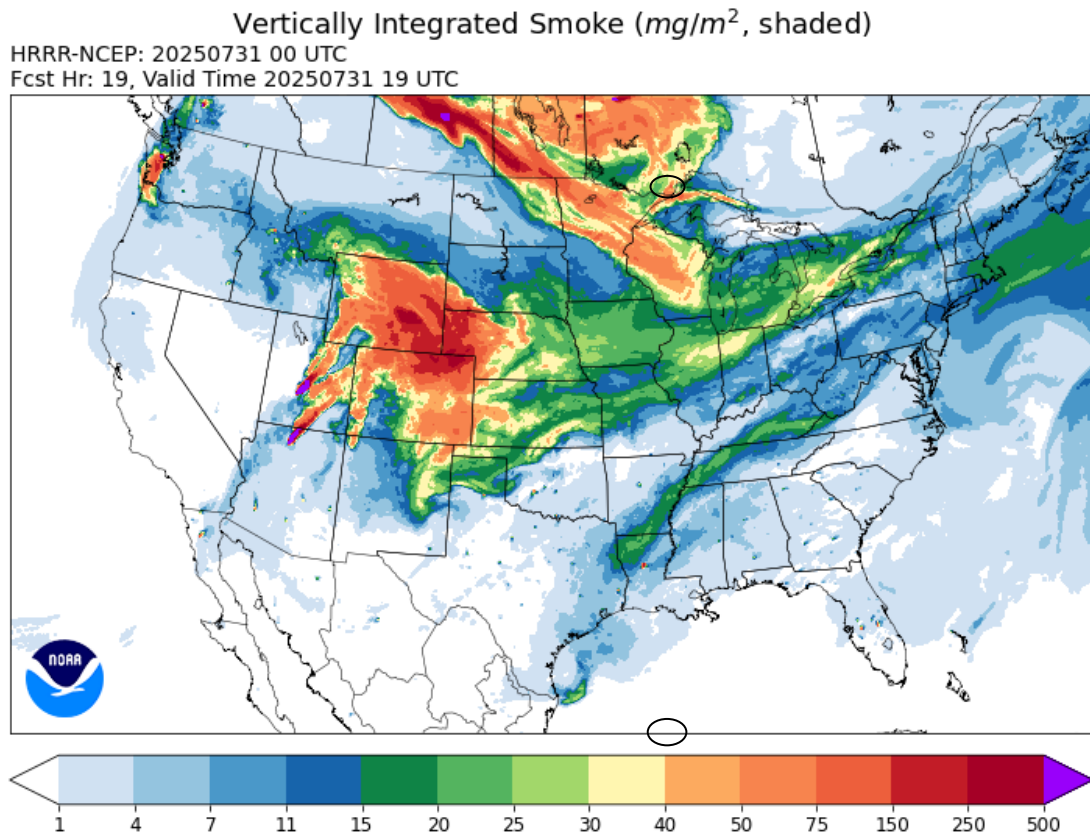
Figure 3.2.9 HYSPLIT Backward Trajectories



3.2.8 HRRR Model

The HRRR is a NOAA real-time 3-km resolution, hourly updated, cloud-resolving, convection-allowing atmospheric model, initialized by 3km grids with 3km radar assimilation. Radar data is assimilated in the HRRR every 15 min over a 1-h period adding further detail to that provided by the hourly data assimilation from the 13km radar-enhanced Rapid Refresh. Figure 3.2.10 indicates the vertically integrated smoke column on the left and the near surface smoke on the right.

Figure 3.2.10 HRRR Smoke - Vertically Integrated and Near Surface Smoke



3.2.9 Media Mentions

Following are links to media articles, detailing the Canadian wildfires that impacted the Midwest, including northwest Indiana.

- [IDEM issues Air Quality Action Day for parts of northern Indiana due to Canadian wildfire smoke](#)
- [Canadian wildfire smoke brings worst air quality in the world to Chicago, creating unhealthy conditions for all](#)
- [Wisconsin air quality among nation's worst as Canadian wildfire smoke spreads](#)
- [Canadian wildfire smoke will continue to foul Michigan's air into Saturday at least](#)
- [Wildfire smoke raises air quality index in northern Illinois](#)

3.2.10 Summary

July 31, 2025	East Chicago-Marina	Hammond-167th St
24-Hour Mean PM_{2.5} Concentration (µg/m³)	60.6	61.5
Five Year Rank	3	3
Tiering Level	1	1
Are UV Carbon and BC Concentrations elevated?	Yes	Yes
Does visual satellite imagery indicate smoke in Lake County?	Yes	Yes
Do AQI maps indicate regionally elevated PM _{2.5} ?	Yes	Yes
Does the HMS product indicate smoke in Lake County?	Yes	Yes
GAM 24-hour Estimated Smoke (µg/m ³)	52.8	52.9
HYSPLIT indicated wildfire regions	EA061, Manitoba, Saskatchewan	
Do HRRR Models indicate smoke?	Yes	Yes
Media Mentions	Yes	Yes
Clear causal relationship established?	Yes	Yes

3.3 August 5, 2025 PM_{2.5} Event

3.3.1 Episode Description

On August 5, 2025, Northwest Indiana experienced PM_{2.5} elevated concentrations at Lake County monitors, with values ranging from 29-32 µg/m³, surpassing the Tier 1 threshold for the Gary-Madison St (180890031), East Chicago-Marina (180890034), and Hammond-167th St (180890036) monitors. Multiple lines of evidence confirm that Canadian wildfire smoke was a key contributor:

- Meteorological conditions on August 5 supported long-range smoke transport into Lake County. Synoptic patterns produced sustained northerly to northwesterly flow, allowing smoke from large Canadian wildfires to move southward across the Great Lakes.
- Satellite Imagery & AOD Analysis: Dense smoke plumes from Canadian Wildfire regions are visible.
- Air Quality Indicators: AirNow maps showed elevated PM_{2.5} concentrations coinciding with smoke presence.
- Modeling Support: GAM analyses estimate up to 23 µg/m³ of PM_{2.5} attributable to wildfire smoke.
- Trajectory Analysis: HYSPLIT back trajectories link air masses directly to the EA061 Fire, Manitoba.

This convergence of observational data, satellite imagery, and modeling establishes a clear causal relationship between wildfire smoke and elevated PM_{2.5} concentrations. These findings support classification of August 5, 2025, as an exceptional event under U.S. EPA guidelines.

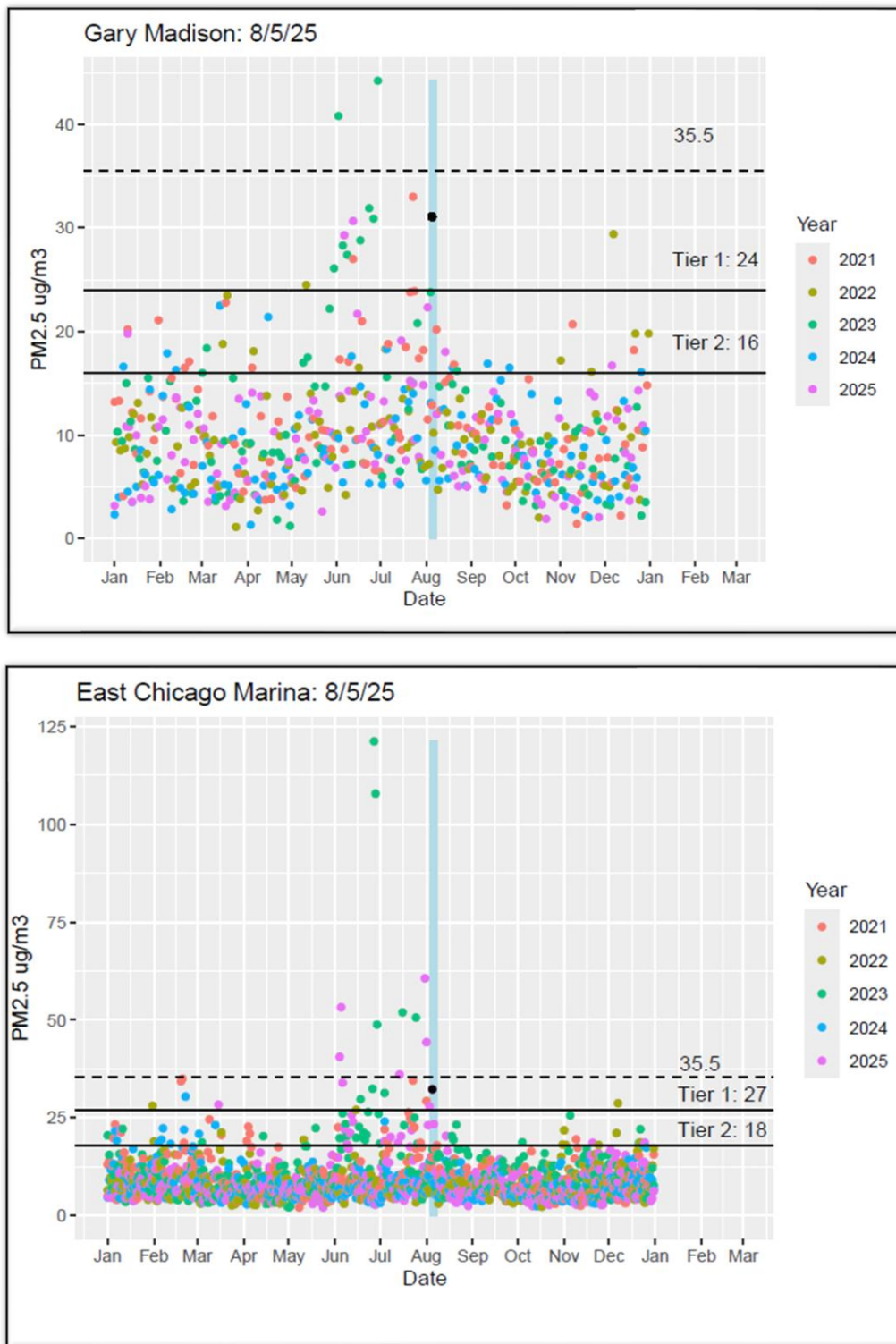
Table 3.3.1 shows the daily PM_{2.5} data from the Gary-Madison St (180890031), East Chicago-Marina (180890034), and Hammond-167th St (180890036) monitors for August 5, 2025. The table shows the 5-year rank among all daily PM_{2.5} concentrations as well as the U.S. EPA Tier 1 and Tier 2 thresholds at the monitors.

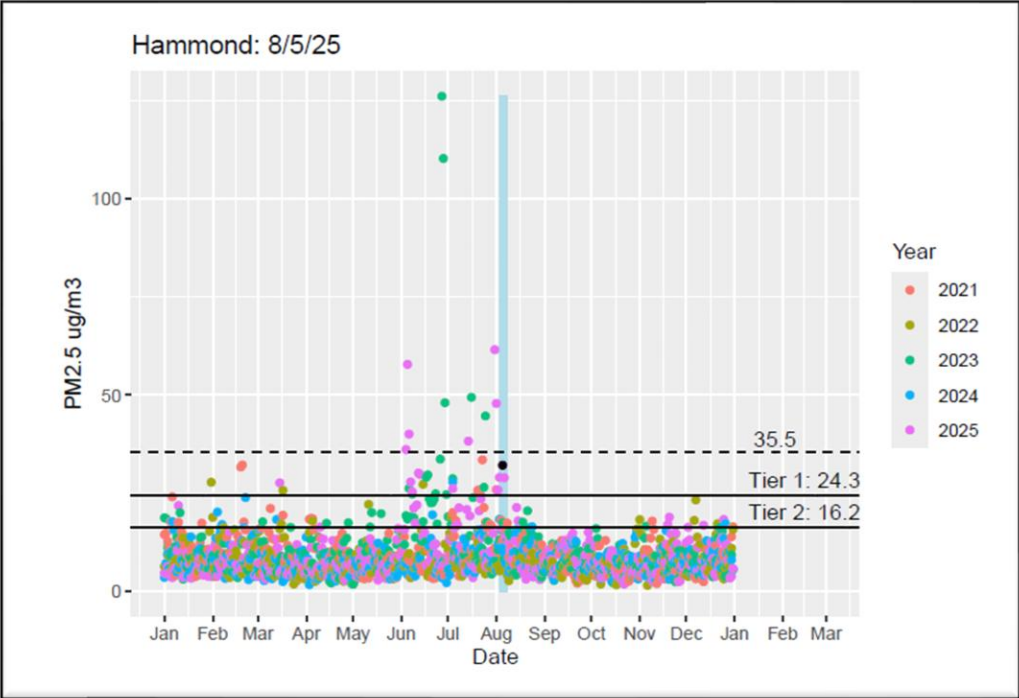
Table 3.3.1- Exceptional Event PM_{2.5} Concentrations (µg/m³) at Lake County Monitors

AQS SITE NAME	Exceptional Event Days	24-Hour Mean PM_{2.5} Concentration	5-year Rank	Tier Day	Tier 1 Threshold	Tier 2 Threshold
Gary-Madison Street	8/5/2025	31.0	2	1	24	16
East Chicago-Marina	8/5/2025	29	18	1	27	18
Hammond-167 th Street	8/5/2025	32.1	12	1	24.3	16.2

Figure 3.3.1 displays daily average PM_{2.5} concentrations for the years 2021 – 2025 at the Lake County PM_{2.5} monitors. This plot shows the average 24-hour PM_{2.5} concentration by year on each day. The figure illustrates the increased PM_{2.5} concentrations relative to other periods of the year and compared to the same period in the past five years as a result of smoke impacts. August 5, 2025, is highlighted in blue and marked with a black dot.

Figure 3.3.1 - Daily Average PM_{2.5} Concentrations at Gary-Madison, East Chicago-Marina, and Hammond-167th St Monitors

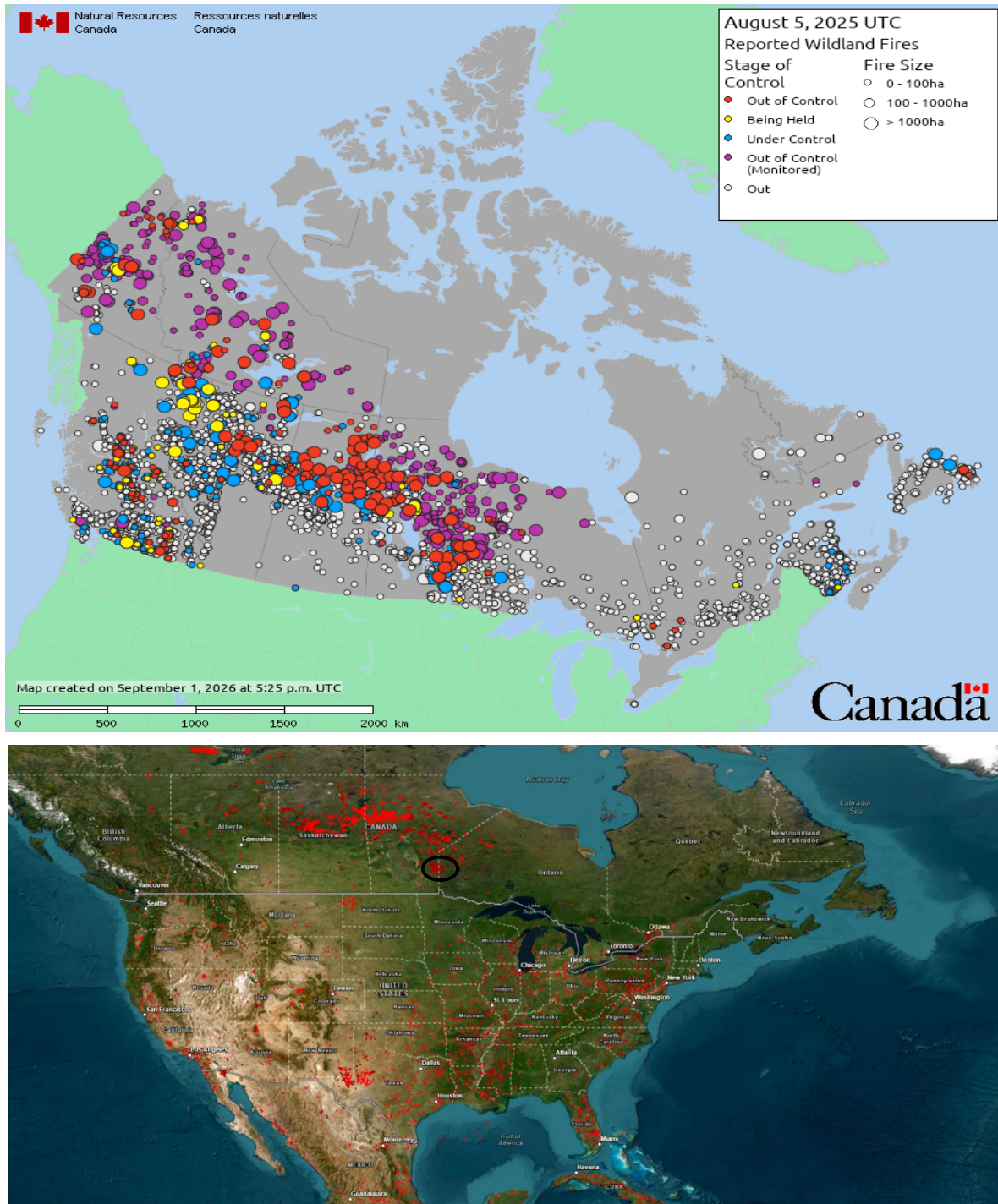




3.3.2 Active Wildland Fires

Figure 3.3.2 displays the active wildfires for August 5, 2025, from The Canadian Wildland Fire Information System and NASA | LANCE | FIRMS US/Canada.

Figure 3.3.2 Active Wildfires August 5, 2025



Fire EA061, circled on the map above, remains out of control at approximately 373,127 ha. This is a fire that was one of many that created the wildland fire smoke in Lake County. The fire started by lightning on May 12, 2025 and was declared under control September 24 and officially out on December 19, 2025.

3.3.3 Meteorological Episode Overview

August 5, 2025 conditions:

Surface analysis based on the WPC Fronts and NDFD weather type maps at 12Z and 00Z shows a surface high pressure ridge anchored along the Mid-Atlantic, while a weak trough extends from the lower Mississippi Valley into Indiana. As these features drift eastward today, expect seasonable temperatures, modest humidity, and a light easterly wind component at the surface. Scattered showers will be confined to the southern half of the state as low-level moisture overruns the trough axis, while areas farther north remain mostly dry under the high's subsidence. According to the NAM at 500 mb, the trough over the central U.S. is lifting out eastward, allowing the 5,880 m geopotential height contour to surge northward. A building ridge over the Desert Southwest will push east, transitioning the upper-level flow from east-southeast to northerly by late afternoon. Early-day vorticity maxima will exit quickly as the trough dissipates, leaving 850 mb winds light from the east-southeast with temperatures near 15 °C. Overall, anticipate a mainly pleasant day with only isolated southern showers and a gradual shift to cooler conditions aloft.

Wildfire Updates:

Smoke from numerous active wildfires in central and eastern Canada has been pushed southward into the Great Lakes region by prevailing high-pressure systems over the eastern United States and southeasterly winds. In addition, some very large fires are burning in the southwest US as well as mentioned in Mondays write up. The haze from the Canadian fires has stretched from Wisconsin and Michigan's Upper Peninsula through northern New York and into parts of Ohio and Pennsylvania, muting blue skies and creating a milky appearance over the lakes and surrounding states. Expect the thickest smoke to linger over the Great Lakes through midweek, with gradual improvements as the plume continues westward and winds shift. Some haziness should persist today, but most areas are forecast to see air quality return to moderate levels by Wednesday or Thursday. A review of the HRRR-NCEP 6Z near surface, 1,000 ft AGL and 6,000 ft AGL forecast indicates some light smoke still circulating along our northern counties today at the surface and 1,000 ft with some lingering into early Wednesday until the prevailing winds shift to a more southerly rather than easterly component. With forecasted mixing heights under 6,000 ft and the NASA GMAO surface fine particulate indicating similar concentrations at or below 20 ug/m³ at the surface we expect smoke impacts to rapidly diminish late tomorrow in the short term. This aging smoke plume has persisted in the region for several days.

The NOAA 6Z BC model shows moderate PM_{2.5} for today and tomorrow. The Canadian model also shows moderate for today but then decreases into the good range for most of the region tomorrow. The Canadian and the HRRR smoke models both show a similar pattern, with a plume of smoke moving through the region today and out tomorrow, lifting

Figure 3.3.3 shows AirNow 24- hour PM_{2.5} surface, 850 mb and 500 mb weather maps, depicting surface and upper air features that enhanced smoke transport into the northwest Indiana area.

500 mb Upper Air Analysis Map

850 mb Upper Air Analysis Map

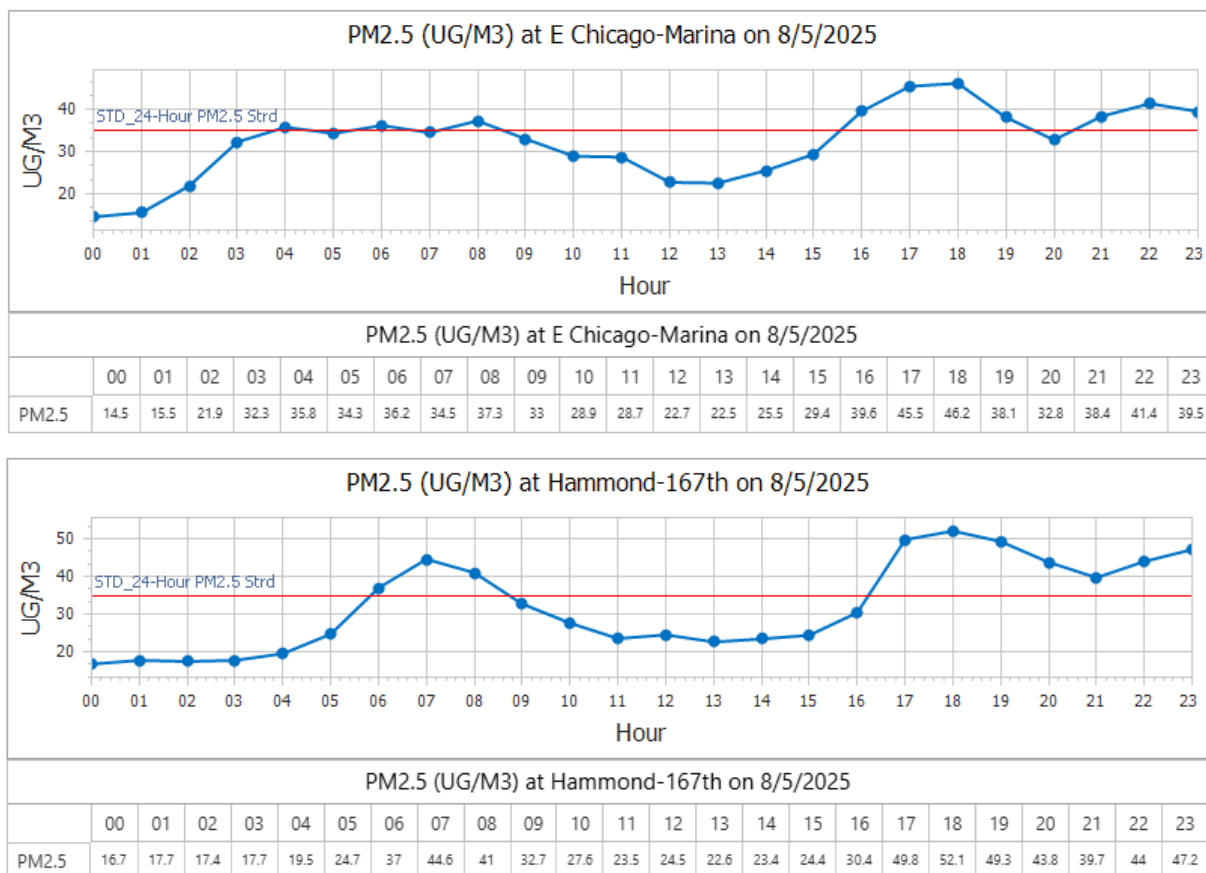
500 mb Geopotential Height [m]

850 mb Geopotential Height [m]

In conjunction with the fire and smoke maps, Figure 3.3.4 shows the hourly PM_{2.5} values from the East Chicago-Marina and Hammond 167th Street monitors. The organic and black

carbon monitored data was from the Gary-IITRI monitor. This monitor is in Lake County about 20 miles away from the two continuous monitors. Particulate matter is the principal pollutant of concern with wildfire smoke, particularly PM_{2.5} which is far smaller than the diameter of a human hair and can be inhaled deeply into the lungs. PM_{2.5} is a complex mixture of solids and aerosols that can contain a myriad of chemical compounds, including metals, organic and elemental carbon, potassium, organic matter and geologic material, and potentially ammonium nitrate and ammonium sulfate ([Camp Fire Air Quality Data Analysis](#)). Organic carbon (OC) is a known chemical tracer for biomass burning and can help track the influence and intensity of PM_{2.5} wildfire smoke. Black carbon is a product of incomplete combustion and is primarily emitted from vehicles, power plants, residential heating, and wildfires. IDEM is only listing monitored parameters such as organic and black carbon and not derived parameters, such as brown carbon, which represents the difference between organic and black carbon. The Gary-IITRI organic and black carbon values were elevated with the Lake County PM_{2.5} concentrations of August 5, indicating the regional extent of the smoke. Both OC and BC daily averages were over the 95th percentile for the five-year period of 2021-2025.

Figure 3.3.4 - Hourly PM_{2.5} and Black Carbon (BC) and Organic Carbon (UV) Concentrations for August 5, 2025



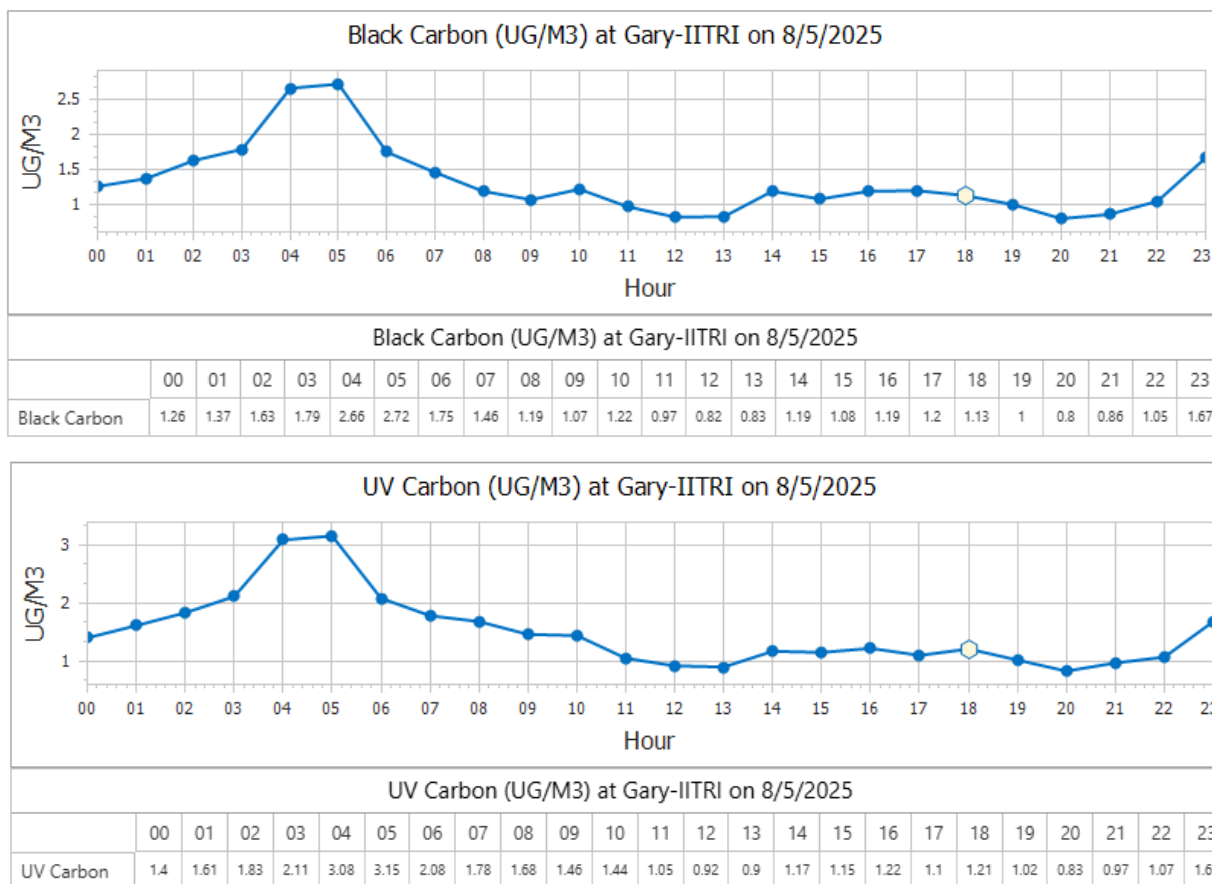
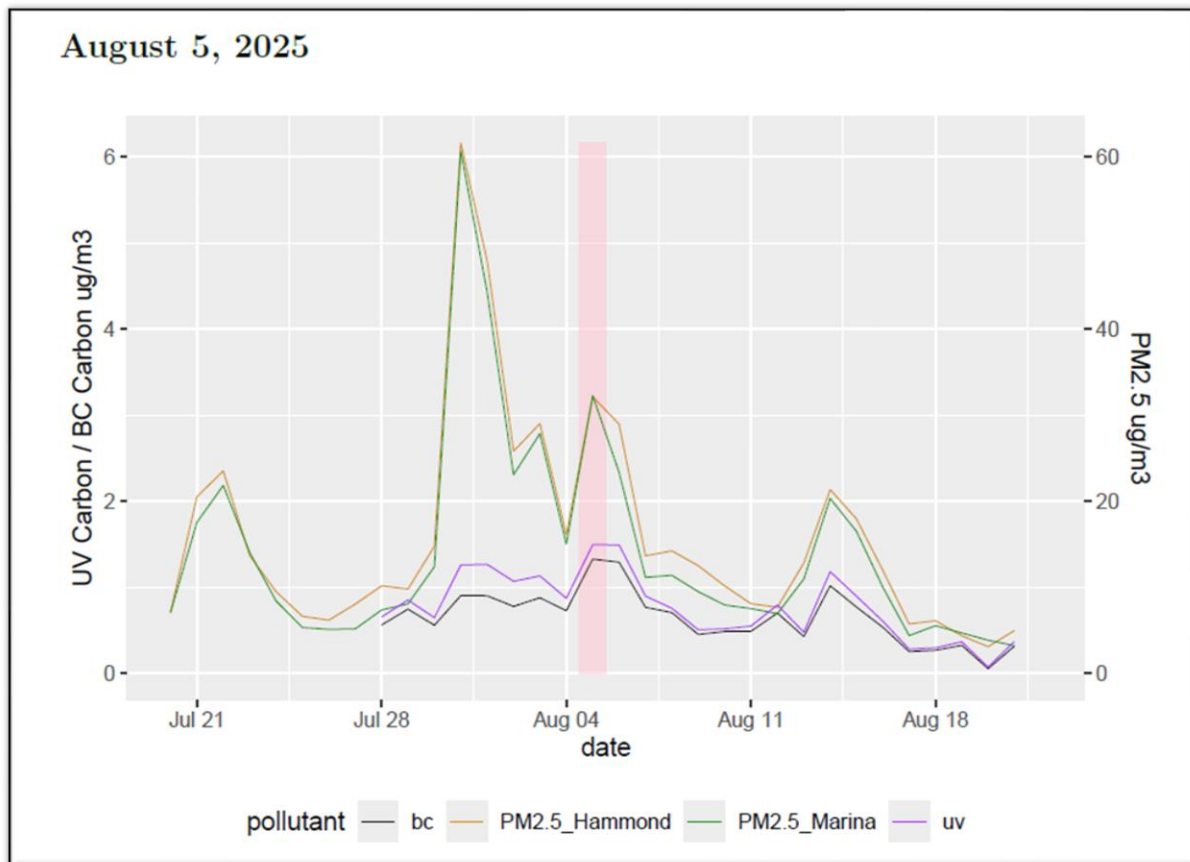


Figure 3.3.5 displays the July/August 2025 OC concentrations measured at the Lake County monitors with August 5 highlighted. Black Carbon is the black line, OC is the purple line, both with concentrations on the left axis. East Chicago- Marina PM_{2.5} is the orange line and Hammond-167th Street is the green line, with the concentration on the right axis. As noted by the spike in PM_{2.5}, OC, and BC concentrations during the end of the month, wildfire smoke impacted the monitor during this time. PM_{2.5} was generally higher during the smoke exceptional event than the average for the two exceptional events during this time period.

Figure 3.3.5 - Organic and Black Carbon Concentrations for July/August 2025



3.3.5 AOD and Satellite Analyses

Figure 3.3.6 displays satellite imagery from Aerosol Optical Depth (AOD) from the Moderate Resolution Imaging Spectroradiometer (MODIS) combined Terra and Aqua Multi-Angle Implementation of Atmospheric Correction (MAIAC) Land Aerosol Optical Depth level 2 product. An optical thickness of less than 0.1 (palest yellow) indicates a crystal-clear sky with maximum visibility, whereas a value of 1 (reddish brown) indicates very hazy conditions. The dark red color in northwest Indiana indicates the presence of smoke.

Figure 3.3.6 Satellite Imagery with MAIAC AOD

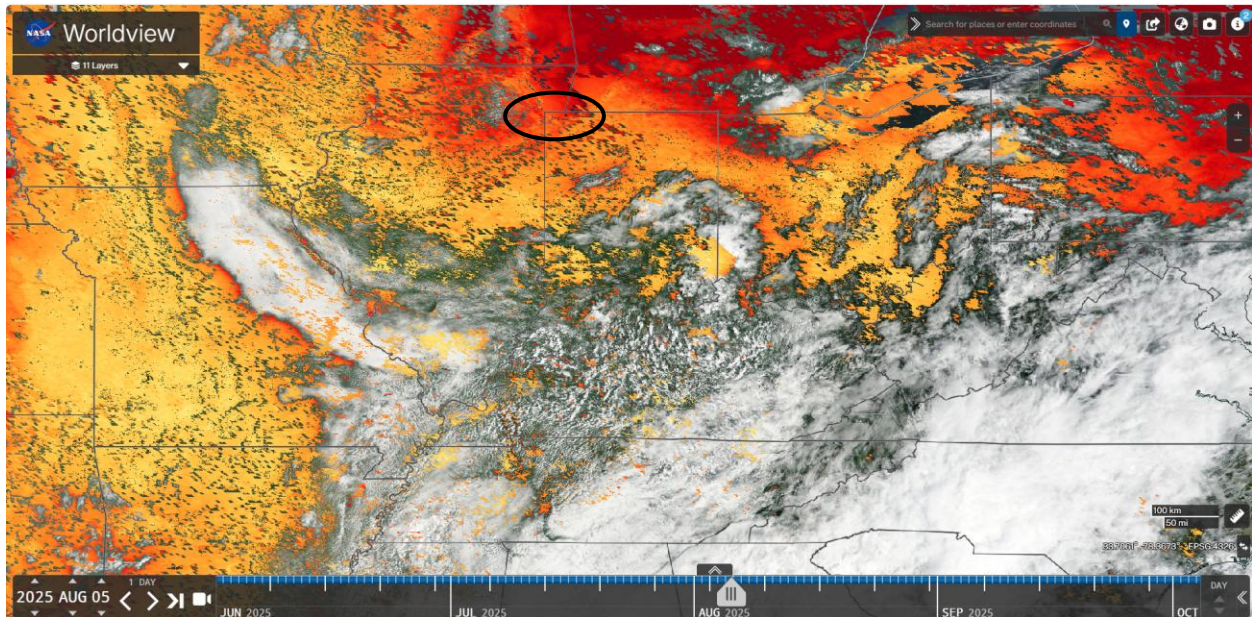
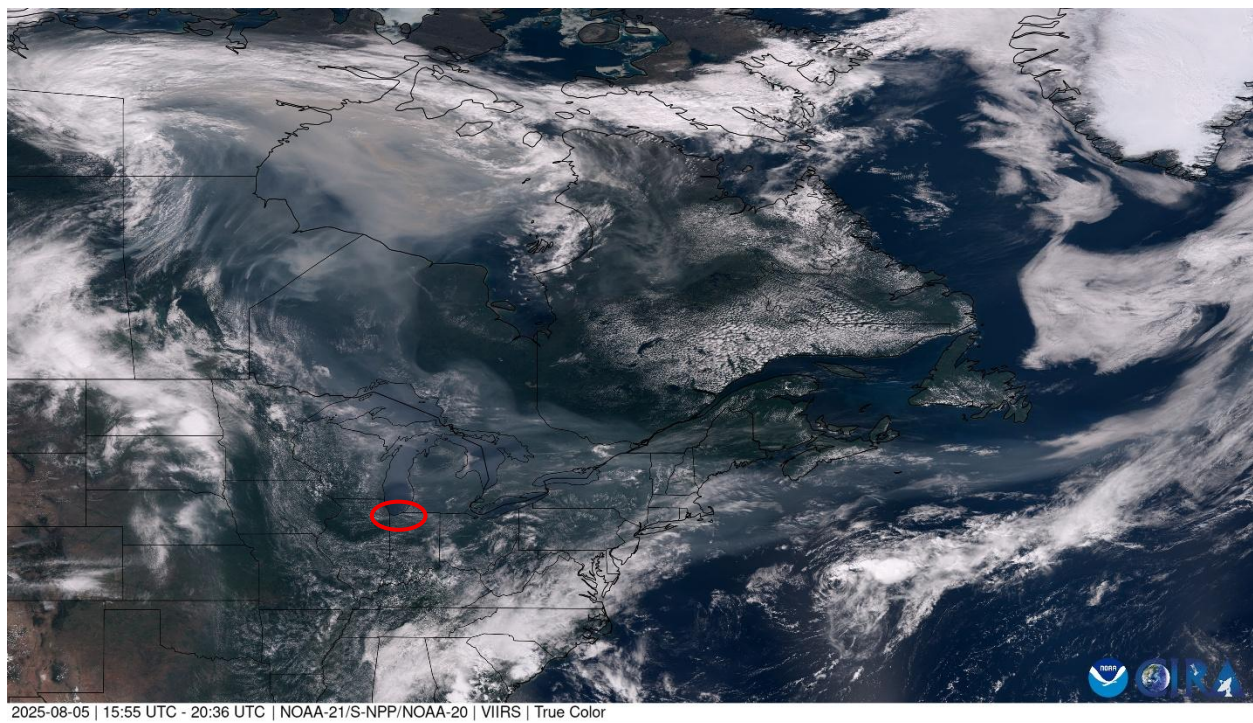
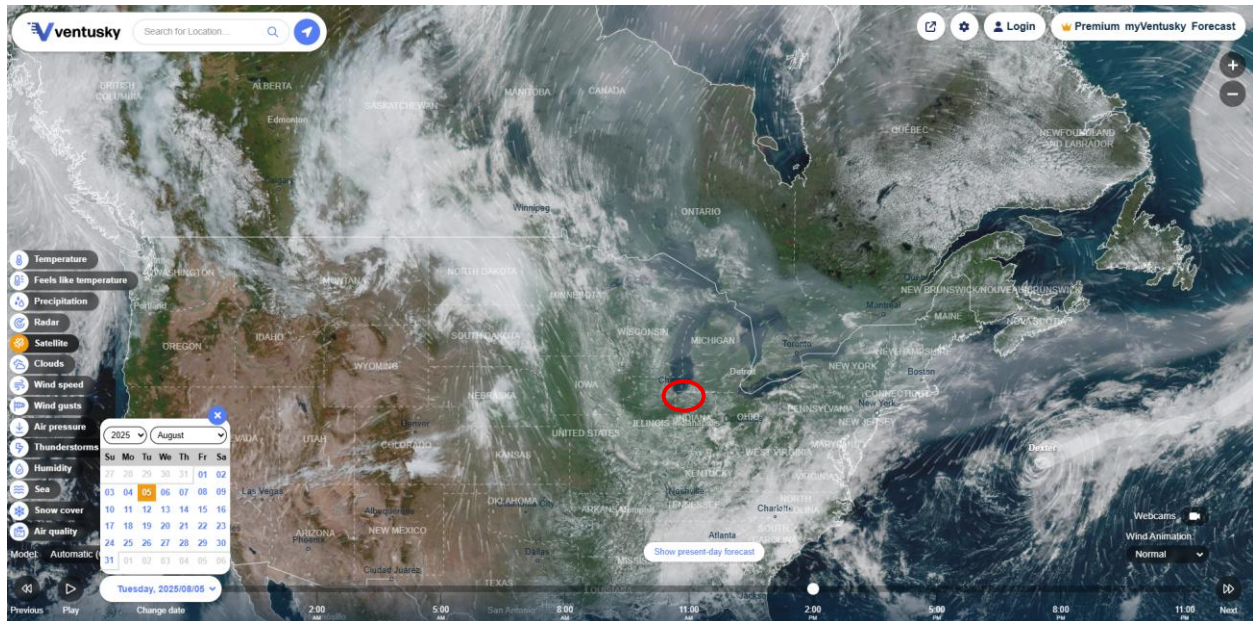


Figure 3.3.7 display two satellite images indicate Canadian wildfire smoke coming from Manitoba, Saskatchewan, and Alberta. August 5th shows heavy smoke from Canada being pushed by the southerly winds into Lake County.

Figure 3.3.7 Satellite Imagery



NOAA Satellite Smoke Forecast

DESCRIPTIVE TEXT NARRATIVE FOR SMOKE/DUST OBSERVED IN SATELLITE IMAGERY
THROUGH 1640Z August 5, 2025

SMOKE:

Canada/CONUS/Atlantic Ocean...

Wildfires in the Northwest Territories, Saskatchewan, and Manitoba continued to produce dense smoke plumes which spread into large areas of moderate-to-heavy smoke that moved east across Ontario and Quebec. Widespread lighter smoke persisted across the northern region of the continent as it circulated to the east, reaching the Atlantic Ocean and across northeastern CONUS, before merging with the smoke over the Midwest region and from southern California.

3.3.6 Smokelyze/GAM Modeling Analysis

To identify the presence of smoke in a region, Smokelyze uses the NOAA Hazard Mapping System (HMS) fire and smoke product (Ruminski et al., 2011; Kaulfus et al., 2017; Buysse et al., 2019). It is based on multiple geostationary satellites and gives a smoke density as high, medium or low. However, as the HMS product is derived from satellite data, it does not provide any vertical information on smoke plumes. The previous analysis (Buysse et al., 2019) indicates that enhanced $PM_{2.5}$ at the surface is found on 30-80% of days with an overhead smoke plume, depending on the location. Nevertheless, the HMS smoke product is critical to identify days when regional $PM_{2.5}$ concentrations are possibly influenced by smoke (Kaulfus et al., 2017). Smokelyze defines any location that is within the boundaries of an HMS smoke plume as $HMS=1$ and a site with no overhead smoke as $HMS=0$.²²

The $PM_{2.5}$ -criteria is a site-specific threshold used to distinguish background "normal" $PM_{2.5}$ from smoke-influenced elevated concentrations. This methodology has evolved to improve robustness against outliers and eliminate abrupt step-changes between adjacent calendar months.

Methodological Improvement: While Lee and Jaffe (2024a; 2024b) utilized a Mean + Standard Deviation (SD) approach, the Median + Median Absolute Deviation (MAD) method was adopted in Lee and Jaffe (2025) and Jaffe et al. (2026) to better handle extreme values and non-normal distributions.

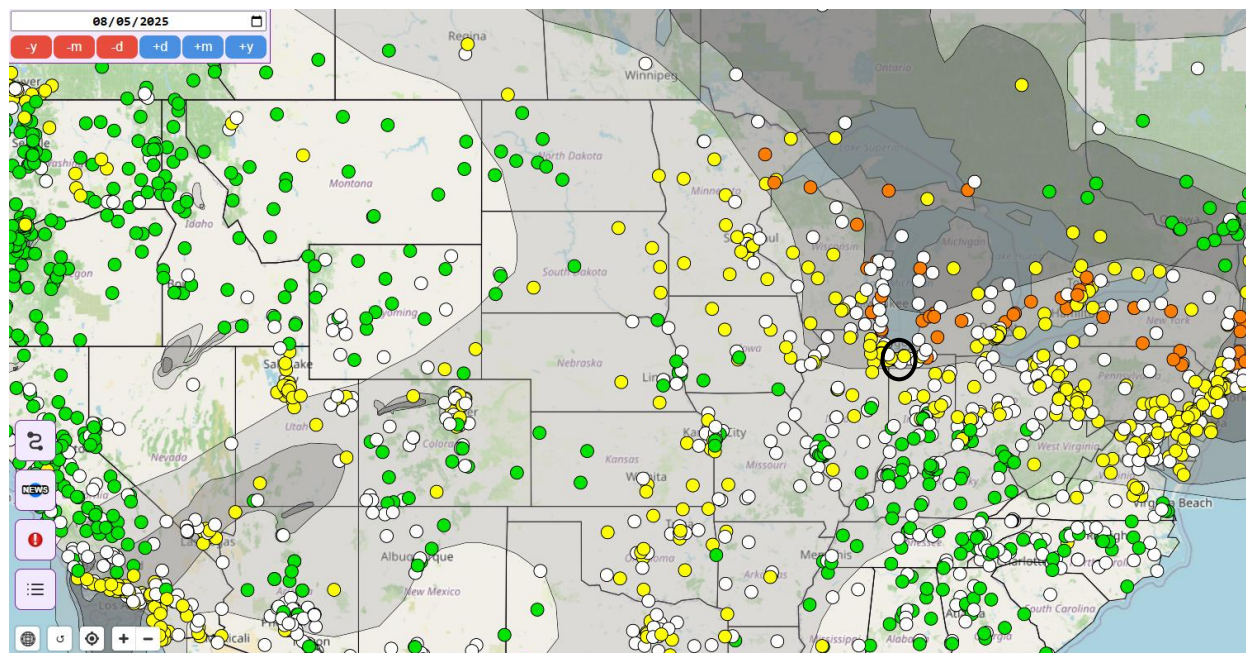
Smokelyze Improvement (5-Yr & 3-Mt Rolling Window): Building upon the Median + MAD foundation from published literature, this web platform adopts a combined 5-year rolling window with a 3-month seasonal rolling window (target month ± 1 month). This enhancement directly addresses the growing risk of baseline sample scarcity, caused by increasingly frequent wildfire smoke events reducing the number of non-smoke ($HMS = 0$)

²² <https://smokelyze.org/resrc/documents/?doc=doc-smoke-impacts>

days, while ensuring sample sufficiency ($n \geq 10$) and eliminating artificial step-changes between adjacent months.²³

Figure 3.3.8 from the Smokelyze app shows the AirNow observed $PM_{2.5}$ concentration for August 5, 2025, with the HMS -Smoke coverage. Table 3.3.2 shows the estimated smoke contribution to the $PM_{2.5}$ concentration.

Figure 3.3.8 Smokelyze Observed $PM_{2.5}$ With HMS-Smoke



²³ <https://smokelyze.org/resrc/documents/?doc=doc-pmcrit>

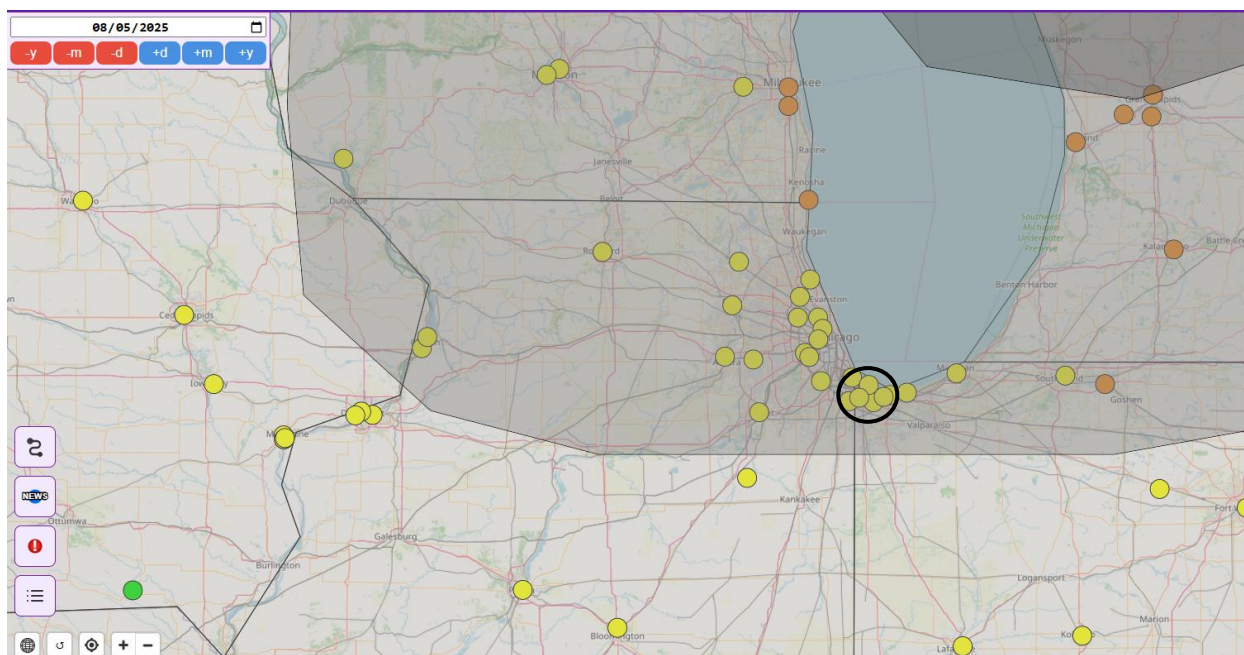


Table 3.3.2 Smokelyze/GAM Estimated Smoke Contribution

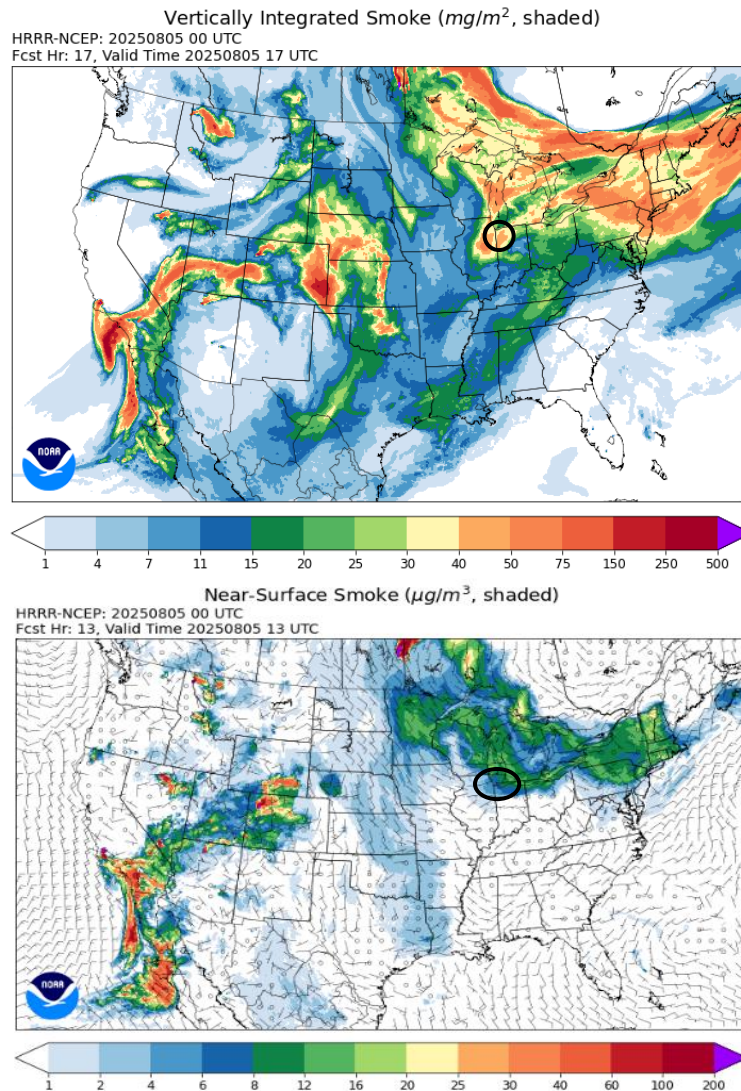
Monitor Name	AQS	Daily Average ($\mu\text{g}/\text{m}^3$)	GAM Estimated Smoke Contribution ($\mu\text{g}/\text{m}^3$)
Gary - Madison St	180890031	31.0	18.4
East Chicago - Marina	180890034	29.0	22.5
Hammond-167th St	180890036	32.1	23.6

3.3.7 HYSPLIT Backward Trajectories

HYSPLIT Backward Trajectories provide 5-day backward air parcel trajectories from all active monitors for ozone, fine particulate matter ($\text{PM}_{2.5}$), particles with diameters less than 10 microns (PM_{10}), and sulfur dioxide (SO_2), covering 2023 through the most current design value year. Each trajectory is analyzed to determine spatial intercepts with NOAA's Hazardous Mapping System (HMS) smoke polygons, helping identify when transported smoke may have influenced conditions at the monitoring site. An "intercept" indicates a spatial overlap between the trajectory and an HMS smoke polygon, but it is not conclusive evidence that the air parcel traveled through the smoke plume. HMS classifies smoke plume density as heavy, medium, or light. This tool only considers heavy and medium smoke plume density. Figure 3.3.9 shows the trajectories for August 5th.

The HPRP is a NO

Figure 3.3.10 HRRR Smoke - Vertically Integrated and Near Surface Smoke



3.3.9 Media Mentions

Following are links to media articles, detailing the Canadian wildfires that impacted the Midwest, including northwest Indiana.

- [Wildfire smoke worsened air quality again Tuesday](#)
- [Air quality alert issued for northwest Indiana as wildfire smoke continues](#)
- [Canadian wildfire smoke again blowing into Illinois](#)
- [Canadian wildfire smoke is lingering over Michigan. Where are the fires burning?](#)
- [Why is the air quality bad in Ohio? Blame Canada. See wildfire smoke maps](#)
- [Canada wildfires cause poor air quality in the Midwest and northeast U.S.](#)
- [Manitoba Fire Bulletin #59](#)

3.3.10 Summary

August 5, 2025	Gary-Madison St	East Chicago-Marina	Hammond-167th St
24-Hour Mean PM _{2.5} Concentration (µg/m ³)	31	29	32.1
Five Year Rank	2	18	12
Tiering Level	1	1	1
Are UV Carbon and BC Concentrations elevated?	Yes	Yes	Yes
Does visual satellite imagery indicate smoke in Lake County?	Yes	Yes	Yes
Do AQI maps indicate regionally elevated PM _{2.5} ?	Yes	Yes	Yes
Does the HMS product indicate smoke in Lake County?	Yes	Yes	Yes
GAM 24-hHur Estimated Smoke (µg/m ³)	18.4	22.5	23.6
HYSPLIT indicated wildfire regions	EA061, Manitoba, Saskatchewan		
Do HRRR Models indicate smoke?	Yes	Yes	Yes
Media Mentions	Yes	Yes	Yes
Clear causal relationship established?	Yes	Yes	Yes

4.0 Not Reasonably Controllable or Preventable

This section addresses the “submission of demonstration” requirement (40 CFR Part 50.14(c)(3)(iv)(D)) that the event was “both not reasonably controllable and not preventable”.

According to 40 CFR Part 50.14(b)(4):

The Administrator shall exclude data from use in determinations of exceedances and violations where a State demonstrates to the Administrator's satisfaction that emissions from wildfires caused a specific air pollution concentration in excess of one or more national ambient air quality standard at a particular air quality monitoring location and otherwise satisfies the requirements of this section.

Provided the Administrator determines that there is no compelling evidence to the contrary in the record, the Administrator will determine every wildfire occurring predominantly on wildland to have met the requirements identified in paragraph (c)(3)(iv)(D) of this section regarding the not reasonably controllable or preventable criterion.

The 2025 Canadian wildfires burned boreal forests which meet the definition of wildlands. Therefore, there is no compelling evidence to contradict that the 2025 Canadian wildfires burned on wildlands, affected Lake County PM_{2.5} monitors, qualify as natural events, and meet the criteria of being “both not reasonably controllable and not reasonably preventable”.

5.0 Natural Event or Human Event not likely to Recur

This section addresses the “submission of demonstration” requirement (40 CFR Part 50.14(c)(3)(iv)(E)) that the event “was a human activity that is unlikely to recur at a particular location or was a natural event”.

Under 40 CFR Part 50.1(k):

“A natural event means an event and its resulting emissions, which may recur at the same location, in which human activity plays little or no direct causal role, anthropogenic sources that are reasonably controlled shall be considered to not play a direct role in causing emissions.”

Furthermore, 40 CFR Part 50.1(n) defines:

“Wildfire is any fire started by an unplanned ignition caused by lightning; volcanoes; other acts of nature; unauthorized activity; or accidental, human caused actions, or prescribed fire that has developed into a wildfire. A wildfire that predominantly occurs on wildland is a natural event.”

Fire EA061 was a massive, naturally sparked wildland fire that burned approximately 373,127 hectares across eastern Manitoba during the severe 2025 wildfire season.

- **Discovery Date:** Discovered on May 12, 2025, originating near the Bird River area.
- **Cause:** Natural ignition (such as lightning).
- **Peak Size:** Expanded significantly over the spring and summer, reaching over 373,127 hectares—making it roughly five times the total land area of Winnipeg and one of the largest single blazes in the province that year.
- **Status:** Remained out of control and actively smoldering for months before eventually being brought to a "being held" status later in the summer.
- **Parks Affected:** Burned heavily through Nopiming Provincial Park and spread toward Wallace Lake, South Atikaki, and Atikaki Provincial parks.
- **Evacuations:** Prompted mandatory evacuation orders for local communities like Bissett and temporary closures/evacuations across parts of Nopiming and surrounding provincial parks.



Therefore, the Canadian wildfires qualify as natural events and meet the criteria of “was a human activity that is unlikely to recur at a particular location or was a natural event”.

6.0 PUBLIC PARTICIPATION

To be completed upon completion of the public comment period.

In accordance with 40 CFR 51.102, IDEM provided an opportunity for public participation concerning the Exceptional Events Demonstration Addressing the 2024 annual PM_{2.5} National Ambient Air Quality Standard (NAAQS) Lake County, Indiana. Notice of availability was posted on IDEM's website under "Public Notices: Lake County" on **October X**, 2026, and remained posted for at least 30 days.

IDEM declared and Air Quality Action Day(<https://www.in.gov/idem/airquality/air-quality-action-day-aqad-advisories>) for Lake County on July 31, 2025, and August 5, 2025.

- The Indiana Department of Environmental Management (IDEM) has declared that today Thursday, July 31 is an Air Quality Action Day in our region for Fine Particulate Matter.
Ozone: Good
Particulate Matter (PM^{2.5}):Unhealthy for Sensitive Groups
Fine particulate matter settles deep into the lungs and cannot be easily exhaled. Sensitive groups (people with respiratory diseases, older adults, and children) should reduce prolonged outdoor exertion and continue checking air quality throughout the week to determine when it is best to be active outdoors.²⁴
- IDEM Forecasts Air Quality Action Day in Northern Regions for Tuesday
INDIANAPOLIS – The Indiana Department of Environmental Management (IDEM) has forecast an air quality action day (AQAD) across the northern section of the state for Tuesday, August 5.
Fine particulate matter levels are expected to be in the Unhealthy for Sensitive Groups range (Orange) in the following areas:
Northwest Indiana, including the cities of: Crown Point, Gary, Hammond, Kentland, LaPorte, Michigan City, Portage, Rensselaer, Valparaiso, and all other cities within the area.
Canadian wildfire smoke circulating in the region will be pulled into northern Indiana Tuesday. Fine Particulate monitor readings will increase as the plume of smoke moves across the region.
IDEM forecasted Air Quality Action Days indicate anticipated higher levels of ground-level ozone and fine particulate matter only. Other factors may affect overall air quality.
IDEM forecasts are based, solely or in part, on data from air quality monitors located throughout the state. IDEM encourages residents of counties within or

²⁴ <https://mishawaka.in.gov/news/air-quality-action-day-thursday-july-31st/>

bordering the affected region(s) to heed the forecast. Air quality information for all Indiana counties can be found at SmogWatch.IN.gov.²⁵

IDEM offers the public near real time access to the statewide air monitoring data ([IDEM: Air Monitoring: Air Quality Data](#)). Through IDEM's Data Management and Display System, anyone has access to near-real time statewide and regional air quality maps and data including:

- The Air Quality Index (AQI) for pollutants including ozone and particulate matter (PM).
- Current pollutant concentrations (including carbon monoxide, nitrogen dioxide, ozone, particulate matter, and sulfur dioxide).
- Meteorological data (including air temperature, barometric pressure, precipitation, relative humidity, solar radiation, and wind speed and direction).
- User-generated reports for ozone and PM.

U. S . EPA has redesigned their AirNow website:

(<https://www.airnow.gov/?city=East%20Chicago&state=IN>). AirNow is your one-stop source for air quality data. Our website and app highlights air quality in your local area first, while still providing air quality information at state and national views. AirNow's interactive map even lets you zoom out to get the big picture or drill down to see data for a single air quality monitor. AirNow's Fire and Smoke map, a collaborative project with the US Forest Service, uses a variety of products including low-cost sensors to provide detailed, up-to-date information that can be critical to users experiencing smoke events.²⁶

²⁵ https://events.in.gov/event/idem-forecasts-air-quality-action-day-in-northern-regions-for-tuesday?utm_campaign=widget&utm_medium=widget&utm_source=State+of+Indiana

²⁶ <https://www.airnow.gov/about-airnow/>

7.0 SUMMARY

This demonstration establishes that elevated PM_{2.5} concentrations observed on July 31, 2025, and August 5, 2025, at the Gary-Madison St (180890031), East Chicago-Marina (180890034), and Hammond-167th St (180890036) monitors in Lake County were primarily driven by long-range transport of Canadian wildfire smoke. Using a comprehensive, multi-method evidence framework, including meteorological analysis, pollutant comparisons, satellite and AOD imagery, statistical modeling, and HYSPLIT trajectory assessments, the analysis consistently links each exceedance event to substantial smoke impacts. Across the July 31st event, PM_{2.5} and black carbon levels were markedly elevated, with modeling estimating wildfire smoke contributions of up to 52 µg/m³. Satellite data and backward trajectories confirm that air masses arrived directly from large, intense wildfire complexes in Canada. Similarly, across the August 5th event, PM_{2.5} and black carbon levels were markedly elevated, with modeling estimating wildfire smoke contributions of up to 23 µg/m³. Again, satellite data and backward trajectories confirm that air masses arrived directly from large, intense wildfire complexes in Canada.

Because the impacts of wildfire smoke greatly elevated concentrations of PM_{2.5} in the Lake County area, monitored values at the Gary-Madison St (180890031), East Chicago-Marina (180890034), and Hammond-167th St (180890036) monitors on both July 31, 2025, and August 5, 2025, rank as some of the highest observed concentration days in 2021-2025 and are categorized as Tier 1 according to the U.S. EPA PM_{2.5} Tiering Tool. This data has regulatory significance because it causes the 2023-2025 design value for Lake County to exceed the 2024 annual PM_{2.5} NAAQS. Excluding these Tier 1 days results in 2023-2025 design values that attain the 9.0 µg/m³ standard at each of the three monitors. Tables 7.1 through 7.3 summarize the 2023-2025 three-year design values at the Gary-Madison St (180890031), East Chicago-Marina (180890034), and Hammond-167th St (180890036) monitors with and without the requested smoke influenced days. Excluding the Tier 1 days results in a design value below the 9.0 µg/m³ threshold for each monitor for the 2023 - 2025 period.

**Table 7.1 - Annual PM_{2.5} 3-year Design Values at Gary- Madison Street
With and Without the Fire Smoke Days**

Metric	Gary-Madison Street Annual Average PM_{2.5} DV (µg/m³)
2023-2025 DV	9.1
2023-2025 DV with requested days removed	9.0

**Table 7.2 - Annual PM_{2.5} 3-year Design Values at East Chicago-Marina
With and Without the Fire Smoke Days**

Metric	East Chicago-Marina Annual Average PM_{2.5} DV (µg/m³)
2023-2025 DV	9.1
2023-2025 DV with requested days removed	9.0

**Table 7.3 - Annual PM_{2.5} 3-year Design Values at Hammond-167th Street
With and Without the Fire Smoke Days**

Metric	Hammond-167th Street Annual Average PM_{2.5} DV (µg/m³)
2023-2025 DV	9.1
2023-2025 DV with requested days removed	9.0

Collectively, these findings meet U.S. EPA’s Exceptional Events Rule criteria by demonstrating a clear causal relationship and supporting the exclusion of the smoke impacted days in 2025 from regulatory determinations for the 2024 Annual PM_{2.5} NAAQS. Therefore, based on the information and data presented in this demonstration, in accordance with requirements in the Exceptional Events Rule, IDEM requests U.S. EPA’s concurrence with the exclusion of July 31, 2025, and August 5, 2025, from regulatory determinations.