# EXCEPTIONAL EVENTS DEMONSTRATION FOR 2022, 2023, and 2024 $PM_{2.5}$ EXCEEDANCES AT HARRISON, KLEBERG, AND TRAVIS COUNTIES

August 5, 2025

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# SECTION 1: INTRODUCTION AND EXCEPTIONAL EVENT CRITERIA

## 1.1 OVERVIEW

Exceptional events are unusual or naturally occurring events that affect air quality and are not reasonably controllable or preventable. An exceptional event may also be caused by human activity that is unlikely to recur at a particular location. Under §319 of the federal Clean Air Act (FCAA), states are responsible for identifying air quality monitoring data affected by an exceptional event and requesting the United States (U.S.) Environmental Protection Agency (EPA) exclude the data from consideration when determining whether an area is in attainment or nonattainment of a National Ambient Air Quality Standard (NAAQS). EPA has promulgated an exceptional events rule, 40 Code of Federal Regulations (CFR) §50.14, as well as guidance to implement the requirements of the FCAA regarding exceptional events. States are required to identify air quality monitoring data potentially affected by exceptional events by flagging the data submitted into the EPA Air Quality System (AQS) database. If EPA concurs with this demonstration, the flagged data will not be eligible for consideration when making NAAQS compliance determinations.

This document discusses the Texas Commission on Environmental Quality's (TCEQ) proposed exceptional event day flags for fine particulate matter ($PM_{2.5}$) occurring on various dates in 2022, 2023, and 2024, in Harrison County (Karnack monitor), Travis County (Austin Webberville Rd. monitor and Austin North Hills Drive monitor), and Kleberg County (National Seashore monitor). This demonstration shows that concentrations of $PM_{2.5}$ at four air monitoring sites in Harrison County, Travis County, and Kleberg County, respectively, were impacted by exceptional events on 50 days in 2022, 2023, and 2024.

The particulate matter measurements on the proposed exceptional event days are listed below in Table 1-1: *Proposed Exceptional Events in 2022 through 2024*. The event days are also categorized into groups by event type. A map of Texas with the referenced monitors is shown in Figure 1-1: *Map of Texas with Four Monitors Identified for Exceptional Events*, and Table 1-2: *Monitor Details* provides additional information for each monitoring site.

**Table 1-1: Proposed Exceptional Events in 2022 through 2024**

| EE Group | Date | Site Name | Exceedance Concentration (µg/m$^3$) | Type of Event | Tier |
|---|---|---|---|---|---|
| 1 | 06/14/22 | Webberville | 24.2 | African Dust | 2 |
| 2 | 03/01/23 | Webberville | 24.6 | Fire - Mexico/Central America | 2 |
| 3 | 05/05/23 | Webberville | 23.6 | Fire - Mexico/Central America | 2 |
| 4 | 12/31/23 | Webberville | 23.9 | Fireworks | 2 |
| 4 | 01/01/24 | Webberville | 32.7 | Fireworks | 1 |
| 5 | 02/27/24 | Webberville | 25.6 | Fire - Mexico/Central America | 2 |
| 6 | 04/01/24 | Webberville | 34.2 | Fire - Mexico/Central America | 1 |
| 6 | 04/01/24 | National Seashore | 25.2 | Fire - Mexico/Central America | 2 |
| 7 | 04/04/24 | Karnack | 129.1 | Prescribed Fire | 1 |
| 7 | 04/05/24 | Karnack | 188.1 | Prescribed Fire | 1 |
| 7 | 04/06/24 | Karnack | 80.2 | Prescribed Fire | 1 |

| EE Group | Date | Site Name | Exceedance Concentration (µg/m$^3$) | Type of Event | Tier |
|---|---|---|---|---|---|
| 8 | 04/17/24 | Webberville | 23.8 | Fire - Mexico/Central America | 2 |
| 8 | 04/18/24 | Webberville | 24.6 | Fire - Mexico/Central America | 2 |
| 9 | 04/26/24 | Webberville | 23.4 | Fire - Mexico/Central America | 2 |
| 9 | 04/27/24 | Webberville | 30.1 | Fire - Mexico/Central America | 1 |
| 9 | 04/27/24 | National Seashore | 25.3 | Fire - Mexico/Central America | 2 |
| 9 | 04/28/24 | National Seashore | 26.1 | Fire - Mexico/Central America | 2 |
| 10 | 05/07/24 | Webberville | 28.5 | Fire - Mexico/Central America | 2 |
| 10 | 05/08/24 | North Hills | 43.1 | Fire - Mexico/Central America | 1 |
| 10 | 05/08/24 | Webberville | 51.8 | Fire - Mexico/Central America | 1 |
| 10 | 05/08/24 | National Seashore | 32.8 | Fire - Mexico/Central America | 1 |
| 10 | 05/09/24 | Webberville | 35.6 | Fire - Mexico/Central America | 1 |
| 10 | 05/09/24 | National Seashore | 43.7 | Fire - Mexico/Central America | 1 |
| 10 | 05/10/24 | National Seashore | 36 | Fire - Mexico/Central America | 1 |
| 11 | 05/16/24 | National Seashore | 33.3 | Fire - Mexico/Central America | 1 |
| 12 | 05/19/24 | National Seashore | 25.1 | Fire - Mexico/Central America | 2 |
| 12 | 05/20/24 | National Seashore | 24.9 | Fire - Mexico/Central America | 2 |
| 12 | 05/21/24 | Webberville | 31.3 | Fire - Mexico/Central America | 1 |
| 12 | 05/21/24 | National Seashore | 31.4 | Fire - Mexico/Central America | 1 |
| 12 | 05/22/24 | Webberville | 31.6 | Fire - Mexico/Central America | 1 |
| 12 | 05/23/24 | Webberville | 25.2 | Fire - Mexico/Central America | 2 |
| 12 | 05/23/24 | National Seashore | 28.7 | Fire - Mexico/Central America | 1 |
| 12 | 05/24/24 | Webberville | 33.8 | Fire - Mexico/Central America | 1 |
| 12 | 05/24/24 | National Seashore | 28.4 | Fire - Mexico/Central America | 1 |
| 12 | 05/25/24 | Webberville | 32.8 | Fire - Mexico/Central America | 1 |
| 12 | 05/25/24 | National Seashore | 28.4 | Fire - Mexico/Central America | 1 |
| 12 | 05/26/24 | Webberville | 35.6 | Fire - Mexico/Central America | 1 |
| 12 | 05/26/24 | National Seashore | 33.3 | Fire - Mexico/Central America | 1 |
| 12 | 05/27/24 | Webberville | 41.7 | Fire - Mexico/Central America | 1 |
| 12 | 05/27/24 | National Seashore | 38 | Fire - Mexico/Central America | 1 |

| EE Group | Date | Site Name | Exceedance Concentration (µg/m³) | Type of Event | Tier |
|---|---|---|---|---|---|
| 12 | 05/28/24 | National Seashore | 25.1 | Fire - Mexico/Central America | 2 |
| 13 | 06/03/24 | National Seashore | 25.6 | Fire - Mexico/Central America | 2 |
| 13 | 06/04/24 | Webberville | 32.3 | Fire - Mexico/Central America | 1 |
| 13 | 06/04/24 | National Seashore | 30.6 | Fire - Mexico/Central America | 1 |
| 13 | 06/05/24 | National Seashore | 35.7 | Fire - Mexico/Central America | 1 |
| 13 | 06/06/24 | National Seashore | 27.4 | Fire - Mexico/Central America | 2 |
| 14 | 07/30/24 | National Seashore | 25 | African Dust | 2 |
| 14 | 07/31/24 | Webberville | 37.5 | African Dust | 1 |
| 14 | 07/31/24 | National Seashore | 34.1 | African Dust | 1 |
| 14 | 08/01/24 | Webberville | 29.0 | African Dust | 1 |

(µg/m³) = micrograms per cubic meter

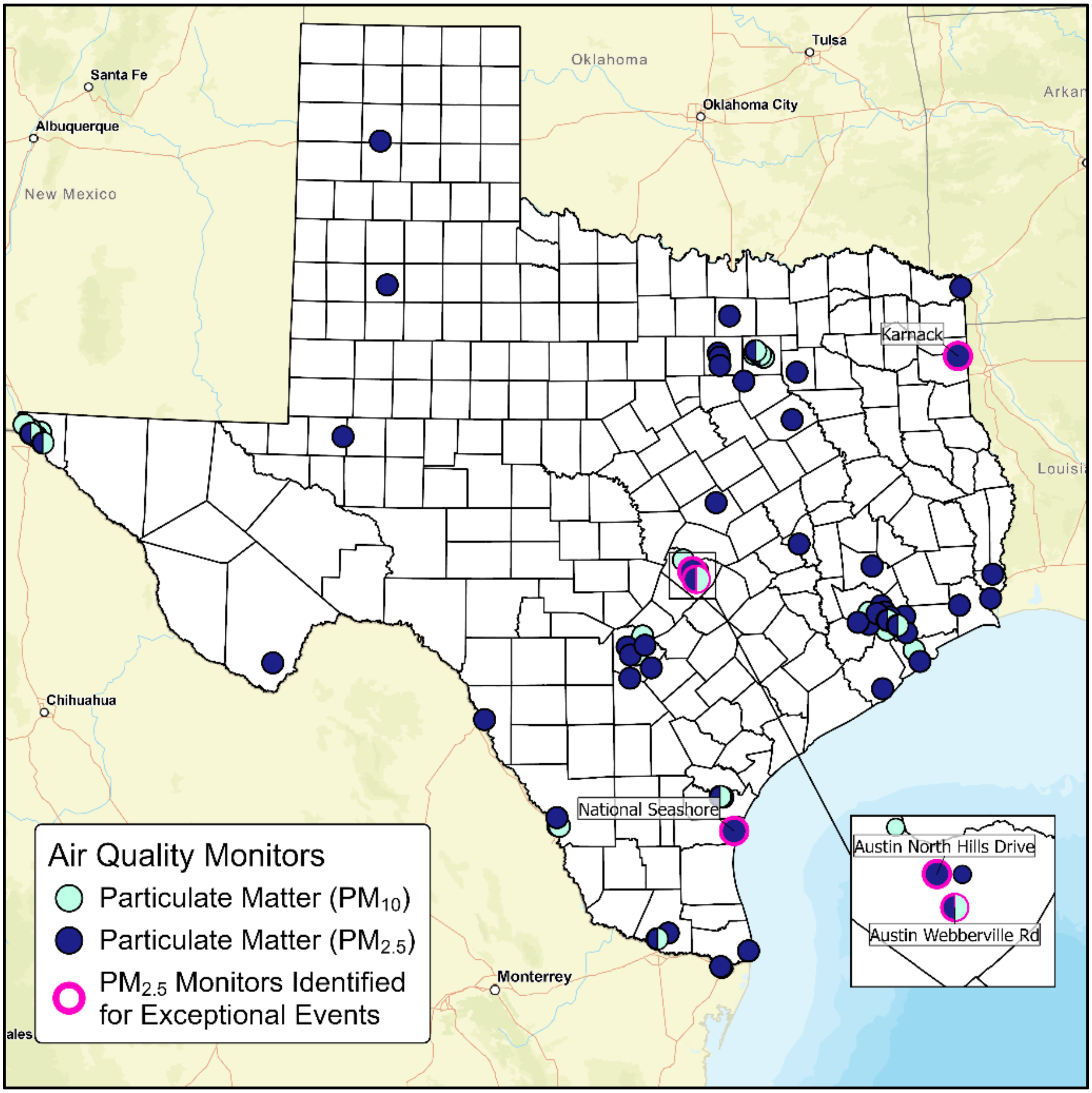


**Figure 1-1: Map of Texas with Four Monitors Identified for Exceptional Events**

**Table 1-2: Monitor Details**

| Site Name | Karnack | Austin Webberville Rd.* | Austin North Hills Drive[†] | National Seashore |
|---|---|---|---|---|
| Air Quality System (AQS) Number | 482030002 | 484530021 | 484530014 | 482730314 |
| Activation Date | June 30, 2001 | September 29, 1999 | January 1, 1979 | October 25, 2002 |
| Address | Hwy 134 & Spur 449 | 2600B Webberville Rd | 3824 North Hills Dr | 20420 Park Road |
| County | Harrison | Travis | Travis | Kleberg |
| Latitude/Longitude | 32.6689906, -94.1674541 | 30.2632109, -94.7128865 | 30.3549341 -97.7617374 | 27.4224225, -97.3008586 |
| Pollutant Instrumentation | $NO_X$, $O_3$, $PM_{2.5}$ | PM Coarse, $PM_{2.5}$ | $NO_X$, $O_3$, $PM_{2.5}$, $SO_2$ | $PM_{2.5}$ |
| Meteorological Instrumentation | Temperature, Visibility, Wind, Solar Radiation | Temperature, Wind | Temperature, Wind | Temperature, Wind |

*Referred to as "Webberville" in this document
[†]Referred to as "North Hills" in this document

## 1.2 CLEAN AIR ACT REQUIREMENTS

In 2024, EPA promulgated a lower primary annual $PM_{2.5}$ standard of 9.0 µg/m³. The 2024 primary annual $PM_{2.5}$ standard is met when the three-year average of annual weighted quarterly means is less than or equal to 9.0 $\mu g/m^3$ (40 CFR §50.20).

Texas is submitting this exceptional events demonstration to exclude certain data from the 2022-2024 timeframe.

## 1.3 EXCEPTIONAL EVENTS RULE REQUIREMENTS

On October 3, 2016, EPA revised its Exceptional Events Rule (EER) (40 Code of Federal Regulations (CFR) §50.14(c)(3)), to specify six fundamental elements that a state's demonstration must contain. Those elements and the parts of this demonstration that fulfill those requirements are shown in Table 1-3: *40 CFR §50.14(c)(3) Exceptional Event Demonstration Requirements*.

**Table 1-3: 40 CFR §50.14(c)(3) Exceptional Event Demonstration Requirements**

| 40 CFR §50.14(c)(3) Requirement | Demonstration Section |
|---|---|
| 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). | Section 2 |

| 40 CFR §50.14(c)(3) Requirement | Demonstration Section |
|---|---|
| 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. | Section 3 |
| Analyses comparing the claimed event-influenced concentration(s) to concentrations at the same monitoring site at other times. The Administrator shall not require a State to prove a specific percentile point in the distribution of data. | Section 3 |
| A demonstration that the event was both not reasonably controllable and not reasonably preventable. | Section 4 |
| A demonstration that the event was caused by human activity that is unlikely to recur at a particular location or was a natural event. | Section 5 |
| Documentation that the submitting air agency followed the public comment process. | Section 7 |

Compliance with the EER mitigation requirements in 40 CFR §51.930 with respect to public notification, public education, and implementation of appropriate measures to protect health is documented in Table 1-4: *40 CFR §51.930 Exceptional Event Demonstration Requirements*.

**Table 1-4: 40 CFR §51.930 Exceptional Event Demonstration Requirements**

| 40 CFR §51.930 Requirement | Demonstration Section |
|---|---|
| Provide for prompt public notification whenever air quality concentrations exceed or are expected to exceed an applicable ambient air quality standard. | Section 6 |
| Provide for public education concerning actions that individuals may take to reduce exposures to unhealthy levels of air quality during and following an exceptional event. | Section 6 |
| Provide for the implementation of appropriate measures to protect public health from exceedances or violations of ambient air quality standards caused by exceptional events | Section 6 |

EPA has provided several documents and tools that address exceptional events demonstration requirements, including those listed below.

- The 2016 revisions to the 2007 Exceptional Events Rule (U.S. EPA, 2016a)[1]
- "Guidance on the Preparation of Exceptional Events Demonstrations for Wildfire Events that May Influence Ozone Concentrations" (U.S. EPA, 2016b)[2]
- "2016 Revisions to the Exceptional Events Rule: Update to Frequently Asked Questions" (U.S. EPA, 2020)[3]

[1] https://www.epa.gov/sites/default/files/2018-10/documents/exceptional_events_rule_revisions_2060-as02_final.pdf
[2] https://www.epa.gov/system/files/documents/2023-12/guidance-on-the-preparation-of-ee-wf-ozone.pdf
[3] https://www.epa.gov/sites/default/files/2019-07/documents/updated_faqs_for_exceptional_events_final_2019_july_23.pdf

- “Initial Area Designations for the 2024 Revised Primary Annual Fine Particle National Ambient Air Quality Standard” (U.S. EPA, 2024)[4]
- “$PM_{2.5}$ Wildland Fire Exceptional Events Tiering Document” (U.S. EPA, 2024)[5]
- $PM_{2.5}$ Designations Mapping Tool[6]

## 1.4 INITIAL NOTIFICATION AND FLAGGING DATA IN AQS

The Exceptional Events Rule at 40 CFR §50.14(c)(2) requires an initial notification by the air agency to EPA of a potential exceptional event for which the agency is considering preparing a demonstration. On June 8, 2025, TCEQ submitted an initial notification to EPA Region 6. On July 29, 2025, an addendum was e-mailed revising certain event types. A copy of the initial notification letter and addendum are provided in Appendix D.

## 1.5 REGULATORY SIGNIFICANCE

The annual $PM_{2.5}$ design value (DV) is the weighted annual mean concentration averaged over three consecutive years. Removing the days impacted by exceptional events from 2022, 2023, and 2024 has regulatory significance since those days impact the 2024 annual $PM_{2.5}$ DVs.

Table 1-5: *2024 DVs for the 2024 Annual $PM_{2.5}$ NAAQS* shows the 2024 design values at each monitor without EPA concurrence on TCEQ’s 2022, 2023, and 2024 exceptional events demonstrations and the potential design value if EPA concurs on the proposed exceptional event days.

**Table 1-5: 2024 DVs for the 2024 Annual $PM_{2.5}$ NAAQS**

| Monitoring Site | 2024 DV without EPA Concurrence (µg/m$^3$) | 2024 DV with EPA Concurrence (µg/m$^3$) |
|---|---:|---:|
| Karnack (482030002) | 9.5 | 9.0 |
| Austin Webberville (484530021) | 9.7 | 9.0 |
| Austin North Hills (484530014) | 9.1 | 9.0 |
| National Seashore (482730314) | 9.8 | 9.0 |

## 1.6 ACTION REQUESTED

This document meets all EPA documentation standards for exceptional events, and TCEQ requests EPA concurrence that the dates and concentrations shown in Table 1-1 were caused by exceptional events and should be excluded from regulatory decisions for the 2024 annual $PM_{2.5}$ NAAQS. The data being requested for exclusion have regulatory significance and affect the DVs. This demonstration provides detailed evidence to support concurrence by EPA for the $PM_{2.5}$ exceptional events for the days included in the initial notification letter (Appendix D), which shows “r” flag applied for all types.

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[4] https://www.epa.gov/system/files/documents/2024-02/pm-naaqs-designations-memo_2.7.2024-_-jg-signed.pdf
[5] https://www.epa.gov/system/files/documents/2024-04/final-pm-fire-tiering-4-30-24.pdf
[6] https://www.epa.gov/air-quality-analysis/pm25-tiering-tool-exceptional-events-analysis

# SECTION 2: NARRATIVE CONCEPTUAL MODEL

## 2.1 OVERVIEW

This section satisfies the Exceptional Events Rule Requirement at 40 CFR § 50.14(c)(3)(iv)(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." Included in this section is a description of the 2022, 2023, and 2024 events and the general meteorological conditions that caused high winds, smoke, or dust to impact the four monitoring sites. As identified in Table 1-1, events were categorized into 14 distinct groups based on single day events or episodes with types of events (African Dust, Fires (Mexico/Central America), Prescribed Fires, Fireworks, and High Winds). The Fire - Mexico/Central America event type descriptor is used to denote fire related flags in AQS to ensure consistency in the indication of the jurisdictional origin of the fire (Outside of the United States in Mexico and/or Central America). Unless otherwise specified, all the Fire-Mexico/Central America exceptional events represent fires with origin only in Mexico that impacted monitors in Texas in this demonstration.

## 2.2 HARRISON COUNTY BACKGROUND

Harrison County is in the East Texas region. The county is part of the Longview Metropolitan Statistical Area (MSA) and has a population of approximately 68,839 people. The area covers 916 square miles and is geographically characterized by rolling terrain and extensive forests. Harrison County experiences a subtropical climate with hot, humid summers and mild winters. Rainfall is fairly distributed throughout the year with a peak storm season from April to June.

## 2.3 TRAVIS COUNTY BACKGROUND

Travis County is in the Central Texas Region. The county is part of the Austin-Round Rock-Georgetown Metropolitan Statistical Area (MSA) and has a population of approximately 1,290,188 people. The area covers 1,023 square miles and is geographically characterized by the edge of Edwards Plateau, with the Balcones Escarpment dividing the county. The rugged, hilly terrain features several waterbodies including the Colorado River, which flows through the county. Travis County experiences a subtropical climate with hot, humid summers and mild winters with two distinct rainy seasons in spring and fall.

## 2.4 KLEBERG COUNTY BACKGROUND

Kleberg County is in the coastal plains of the South Texas Region. The county is part of the Kingsville, Texas Micropolitan Statistical Area (MSA) as well as the Corpus Christi-Kingsville-Alice Combined Statistical Area (CSA) and has a population of approximately 31,040 people. The area covers 1,090 square miles and is geographically characterized by grassy plains that include both mainland and parts of Padre Island - a barrier island along the Gulf Coast. Kleberg County experiences a subtropical climate with hot, humid summers and mild winters. Influenced by prevailing southeast winds, rainfall typically peaks in May and September.

## 2.5 NARRATIVE FOR EACH GROUP OF EVENT DAYS

All weather maps, graphs, and smoke layer maps are included in Appendix A and referenced in this section as A-#. The National Oceanic and Atmospheric Administration's (NOAA) National Weather Service (NWS) forecasts are included in Appendix B and referenced in this section as B-#. Imagery and data used for the narrative conceptual model comes from multiple sources:

- Weather maps (surface analysis) were downloaded from NOAA NWS Weather Predication Center: https://www.wpc.ncep.noaa.gov/archives/web_pages/wpc_arch/get_wpc_archives.php.
- Weather maps (500 millibar (mb) height) were downloaded from NOAA NWS Storm Predication Center: https://www.spc.noaa.gov/obswx/maps/.
- Upper air soundings were downloaded either from the University of Wyoming or Plymouth State University: https://weather.uwyo.edu/upperair/sounding.html and https://vortex.plymouth.edu/myowxp/upa/raobplt-a.html.
- As part of its Hazard Mapping System (HMS), NOAA produces daily fire and smoke plume maps depicting the location of fires and smoke plumes detected by satellites (NOAA, 2003). The KML files were downloaded from NOAA and displayed on Google Earth: https://www.ospo.noaa.gov/products/land/hms.html#data.
- NWS forecasts were downloaded from: https://mesonet.agron.iastate.edu/wx/afos/list.phtml. The NWS Weather Forecasts offices used for each monitoring area include:
  - Austin/San Antonio office: Austin North Hills Drive, and Austin Webberville Rd
  - Corpus Christi office: National Seashore monitor
  - Shreveport office: Karnack monitor
- Reported fire data from Mexico is archived by the Mexican government and is available at: https://monitor_incendios.cnf.gob.mx/incendios_tarjeta_semanal. The data contains information about fires from each Mexican state, such as the cause of fire and acreage burned.

### 2.5.1 Group 1 – Summary of June 14, 2022, African Dust $PM_{2.5}$ Event for the Webberville Monitor

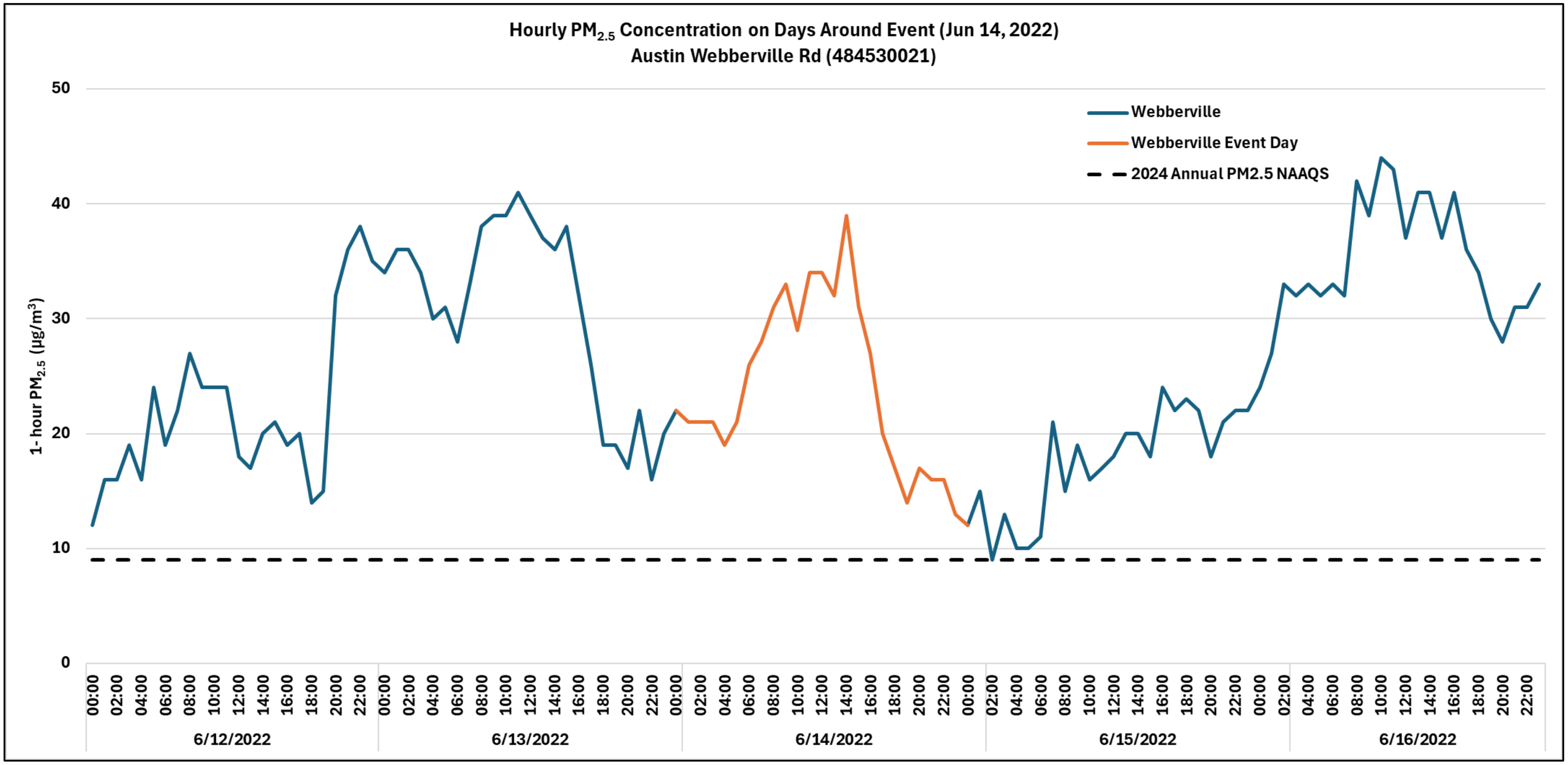


**Figure 2-1: Hourly $PM_{2.5}$ Concentrations on Days around Event (June 14, 2022) for the Webberville Monitor**

African dust affected the Webberville monitor on the afternoon of June 14, 2022. The monitor reached a peak value of 39 micrograms per cubic meter (μg/m$^3$) at 2:00 p.m. CDT, as shown in Figure 2-1: *Hourly $PM_{2.5}$ Concentrations on Days around Event (June 14, 2022) for the Webberville Monitor.*

The surface chart, 500 mb chart, and soundings from Corpus Christi and Shreveport (Figure A-1 through A-6) show that on June 13, 2022, a meridional pattern was present over the continental U.S. with ridging over Texas and the southeastern U.S.. Winds at this level were from the southeast over the coast of Texas, which aided the transport of Saharan dust in the upper atmosphere coming from the Jetstream. Both observed rawinsondes (soundings) from Corpus Christi and Shreveport showed backing winds throughout the atmospheric column. Backing winds, which shift counterclockwise with height, are associated with dynamic sinking. This effect likely aided vertical mixing, bringing the upper-level Saharan dust particles downward towards the surface, where they could impact the air monitors.

On June 14, 2022, the ridging at 500 mb had progressed over the eastern U.S., with continued southeasterly winds over East Texas. This flow continued to aid the transport of upper-level Saharan dust from the jet stream to Texas. Winds at the surface over East Texas were southerly from 15-20 kts, indicating that gradient-level winds were mixing down to the ground level. The sounding from Corpus Christi showed backing winds, which are associated with downward mixing. The subsidence inversion present on both soundings also indicates sinking air, which likely aided the transport of Saharan dust to the surface.

### 2.5.2 Group 2 – Summary of March 1, 2023, Fire (Mexico/Central America) $PM_{2.5}$ Event for the Webberville Monitor

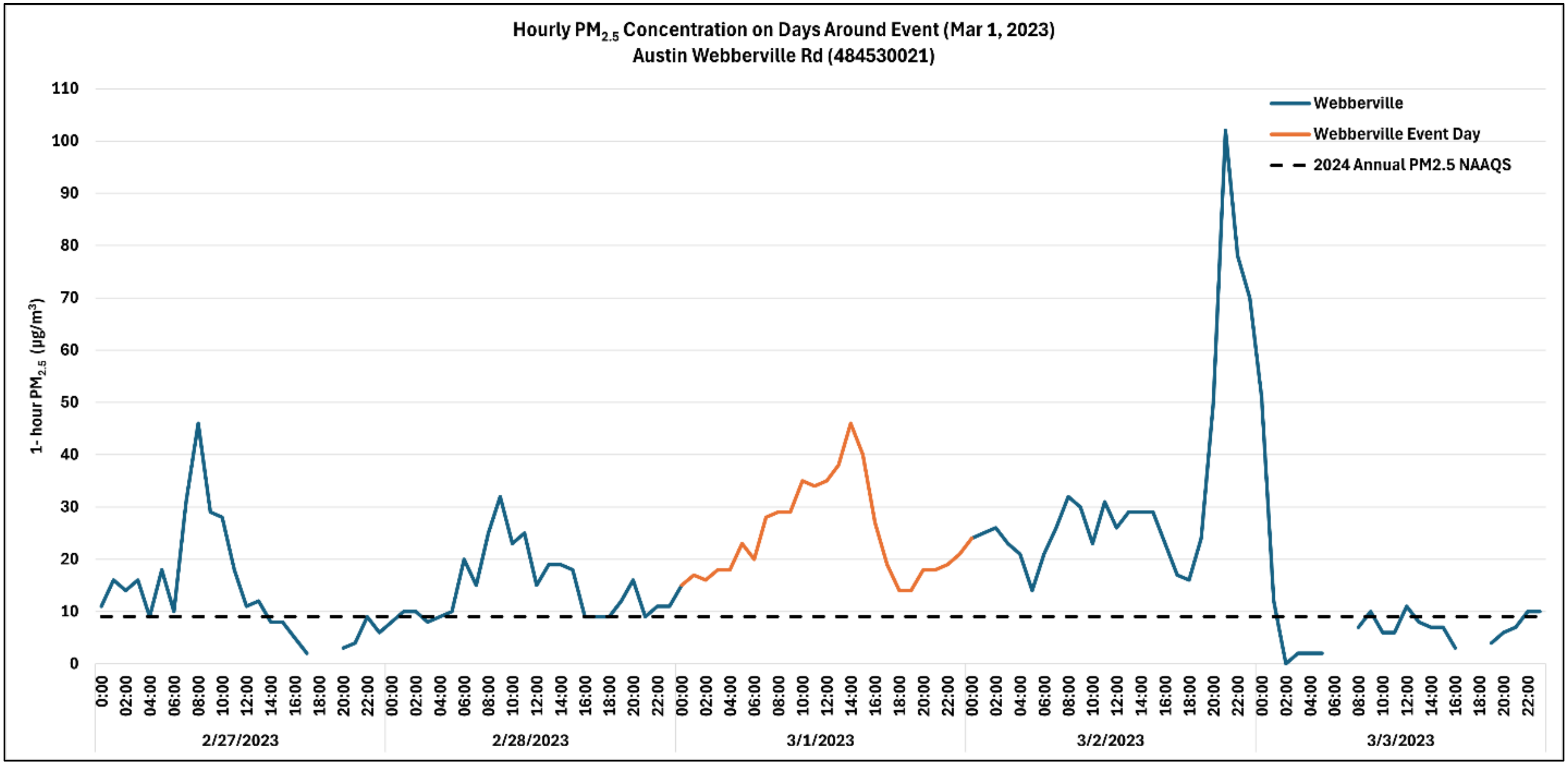


Figure 2-2: Hourly $PM_{2.5}$ Concentrations on Days around Event (March 1, 2023) at the Webberville Monitor

$PM_{2.5}$ concentrations were elevated on March 1, 2023, at the Webberville monitor due to smoke from fires in Mexico, as shown in Figure 2-2: *Hourly $PM_{2.5}$ Concentrations on Days around Event (March 1, 2023) at the Webberville*. Figure 2-3: *Percentage of Reported Fire Instances by the Mexican Government on and around March 1, 2023*, relates the relative frequency of different types of fires in southern Mexico.

The surface chart (Figure A-7) shows a cold front that was upstream of Austin the morning of March 1, 2023. As seen in 500 mb chart (Figure A-8) troughing over the West coast of the U.S. with weak ridging over the central U.S. Flow at this level is from the southwest. This facilitated the transport of smoke from Mexican fires towards the Webberville monitor in Central Texas. Additionally, winds at the surface were from the southeast, which may have transported any smoke that made it over the Gulf of America towards Central Texas as smoke can be seen covering over the Webberville monitor on NOAA HMS map (Figure A-9).

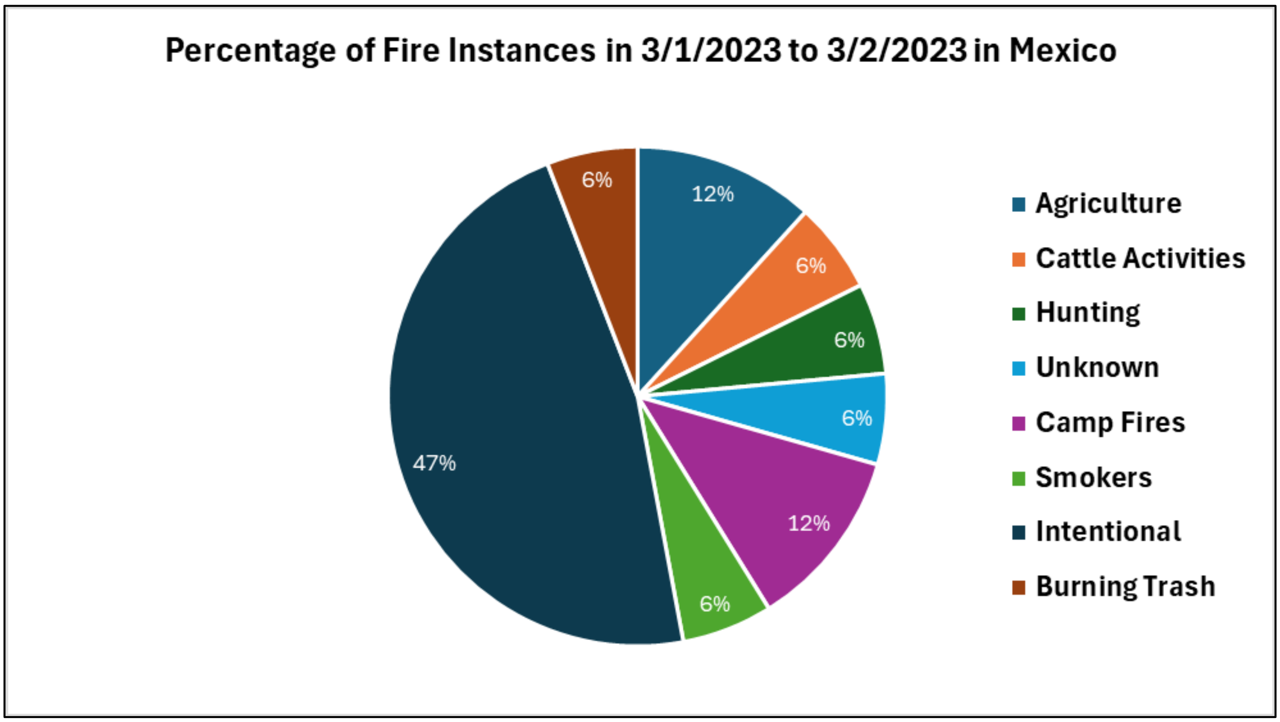


**Figure 2-3: Percentage of Reported Fire Instances by the Mexican Government on and around March 1, 2023**

### 2.5.3 Group 3 – Summary of May 5, 2023, Fire (Mexico/Central America) $PM_{2.5}$ Event for the Webberville Monitor

$PM_{2.5}$ concentrations at the Webberville monitor were elevated between 1:00 a.m. CDT and 9:00 p.m. CDT on May 5, 2023, with peak concentrations occurring on May 16 and 18, as seen in Figure 2-4: *Hourly $PM_{2.5}$ Concentrations on Days around Event (May 5, 2023) at the Webberville Monitor*. The elevated concentrations were due to smoke from fires in Mexico. Figure 2-5: *Percentage of Reported Fire Instances by the Mexican Government on and around May 5, 2023*, shows the causes of reported fires in Mexico, almost half are unlikely to recur (natural and intentional).

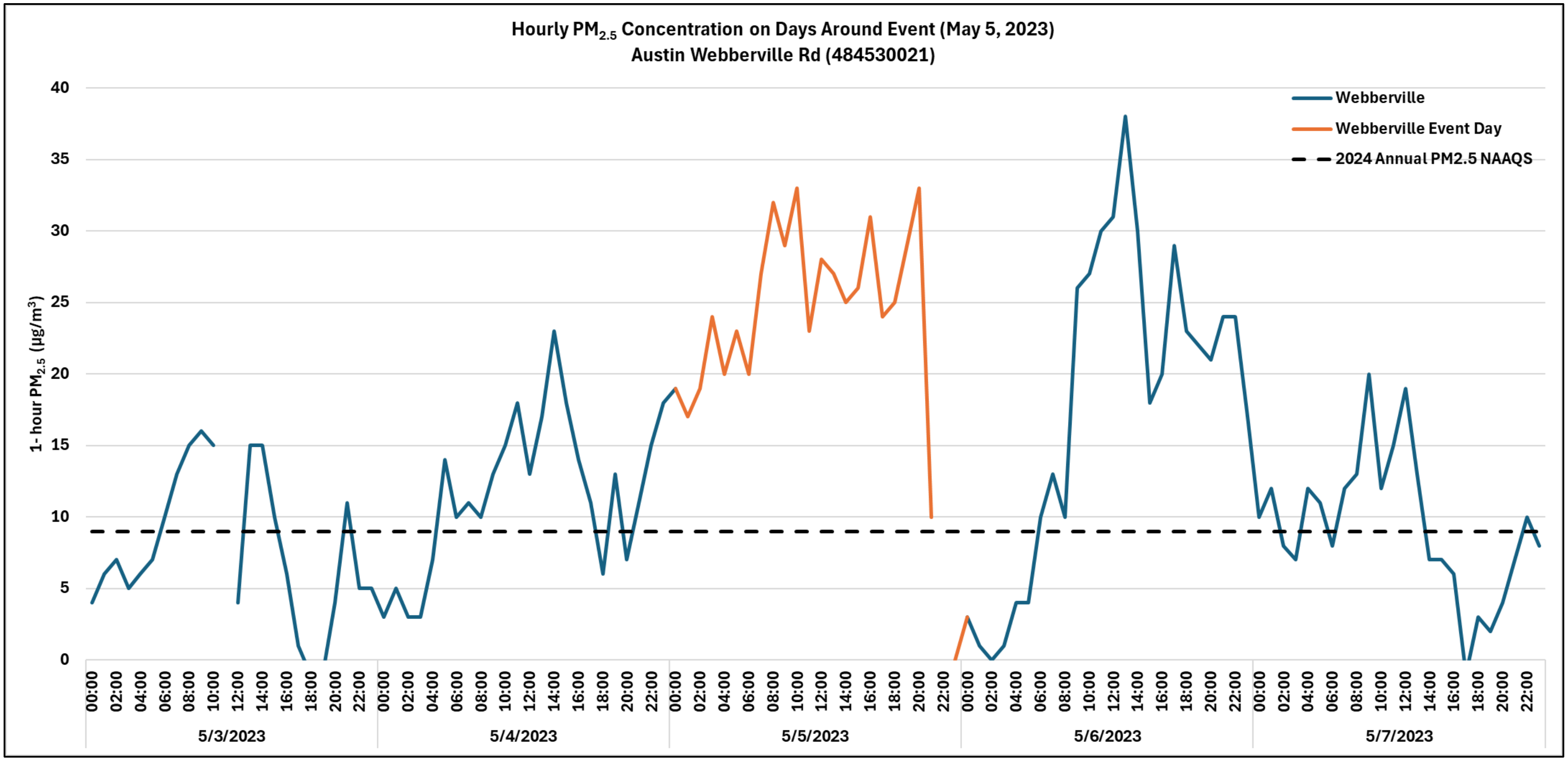


Figure 2-4: Hourly $PM_{2.5}$ Concentrations on Days around Event (May 5, 2023) at the Webberville Monitor

The Central Texas area saw winds out of the south-southeast on May 5, 2023, as shown on the surface weather map with calm winds in Central Texas (Figure A-10). The May 5, 2023, 500 mb heights chart (Figure A-11) shows slight ridging over southern and south-central Texas with flow from the southwest in southern Texas transporting smoke from fires in Mexico towards the Webberville monitor. Medium smoke is indicated on the NOAA hazard map over South Texas (Figure A-13). The lowest levels of the May 5, 2023, Corpus Christi atmospheric sounding (Figure A-12) indicated light veering winds near the surface allowing for some stagnation in the area and persistence of smoky air at the ground level.

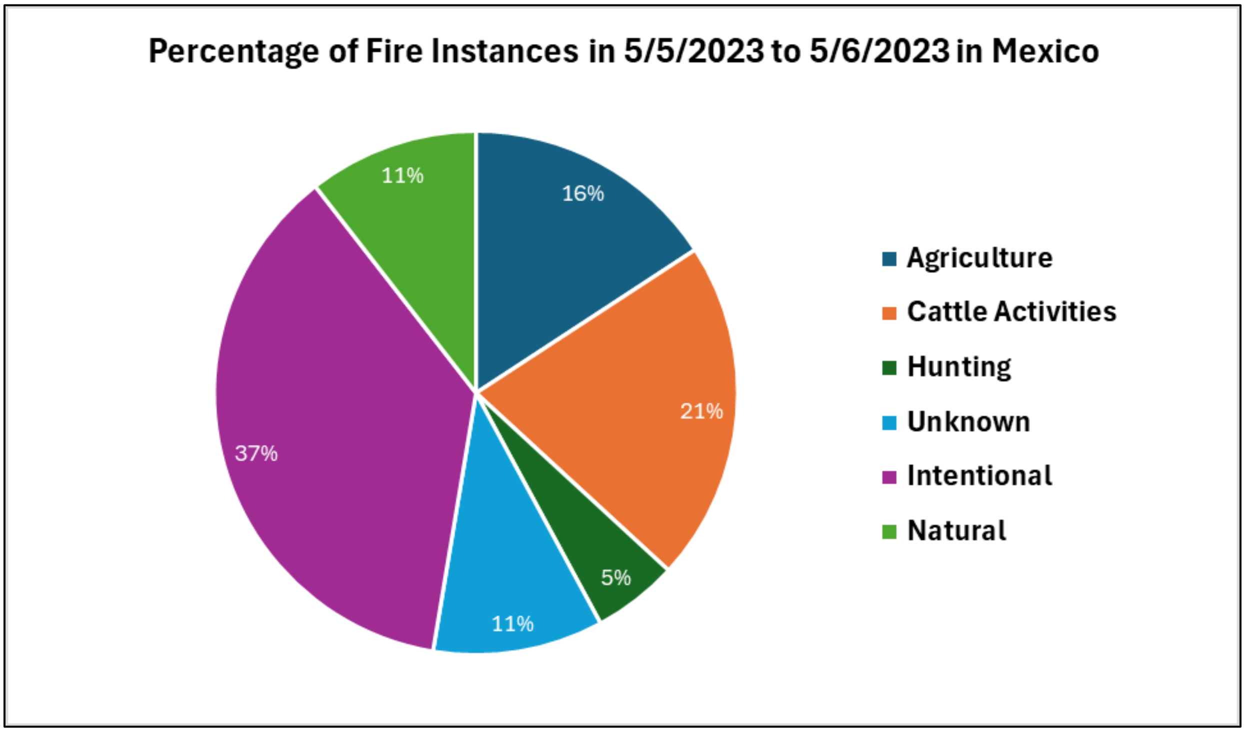


**Figure 2-5: Percentage of Reported Fire Instances by the Mexican Government on and around May 5, 2023**

### 2.5.4 Group 4 – Summary of December 31, 2023, and January 1, 2024, Fireworks $PM_{2.5}$ Event for the Webberville Monitor

Elevated $PM_{2.5}$ concentrations occurred in the late hours of December 31, 2023, and the early hours of January 1, 2024. Concentrations peaked at 220.4 $\mu g/m^3$ around midnight and 235.7 $\mu g/m^3$ in the 1:00 a.m. CST hour on January 1, 2024. Elevated $PM_{2.5}$ concentrations occurred on December 31, 2023, and January 1, 2024, at the Webberville monitor due to New Year's Eve fireworks, as shown in Figure 2-6: *Hourly $PM_{2.5}$ Concentrations on Days around Event (December 31, 2023, and January 1, 2024) at the Webberville Monitor.*

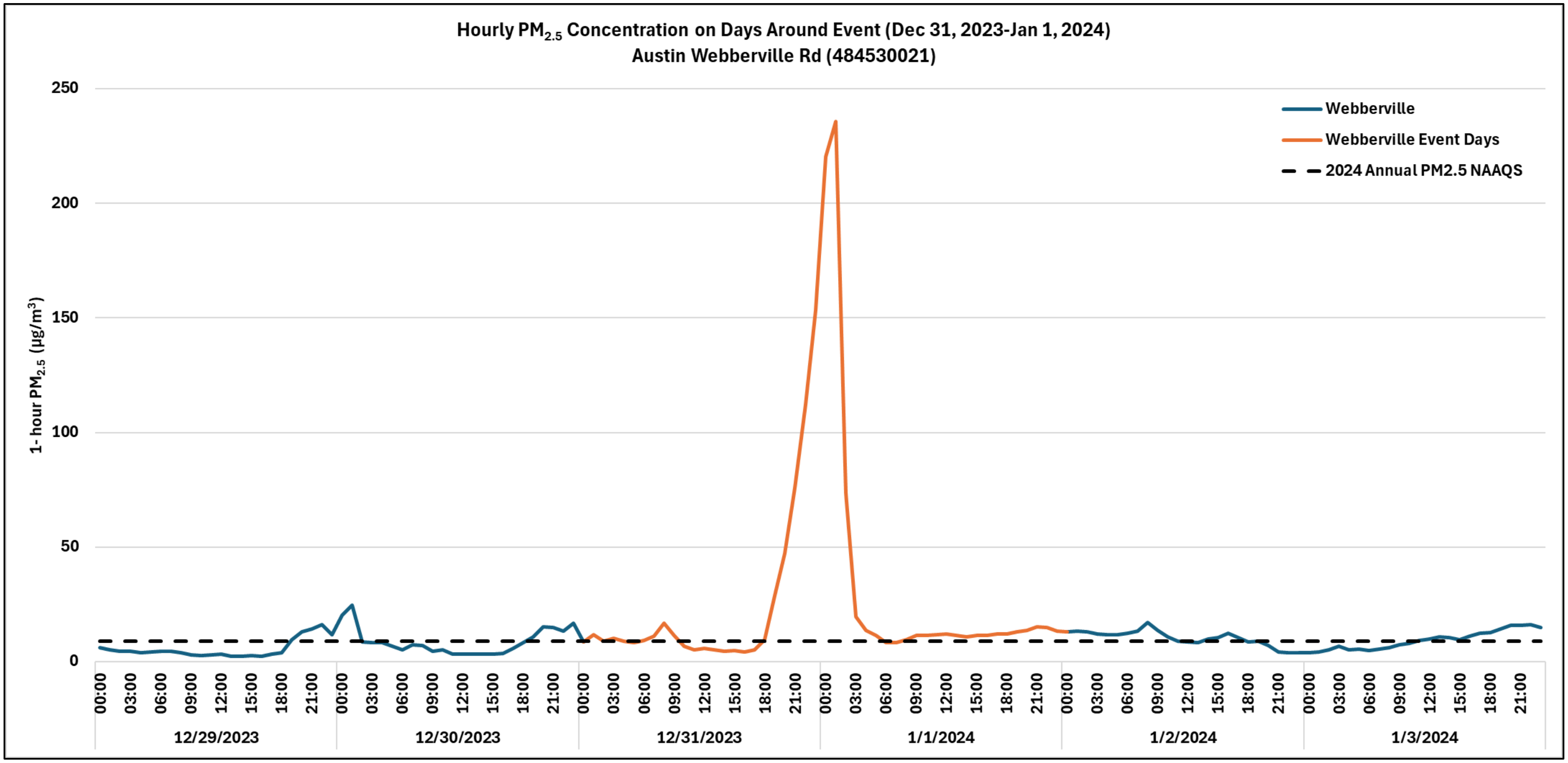


**Figure 2-6: Hourly $PM_{2.5}$ Concentrations on Days around Event (December 31, 2023, and January 1, 2024) at the Webberville Monitor**

On December 31, 2023, near the surface, a cold front was slowly approaching South-Central Texas from the north (Figure A-14). A zonal flow was prevalent over much of Texas as seen in the 500 mb heights map (Figure A-15) below. In Austin, there were light winds and high humidity in the evening, becoming increasingly stagnant toward midnight. Fireworks associated with the celebration of New Year's during the evening combined with the high humidity and stagnant conditions resulted in elevated $PM_{2.5}$ in the Webberville Road monitor area as pollutant dispersal from local fireworks shows was limited. On the first day of 2024 (Figure A-16 and A-17), there was ridging at 500 mb over the central U.S that stacks down to a high-pressure center over Kansas at the surface. This brought subsidence over Texas on January 1, 2024, which increased downward movement of winds in the region. The observed sounding at Lake Charles (Figure A-18) shows a strong radiation inversion in the morning that likely capped mid-level winds from mixing to the surface and subdued any potential vertical diffusion of particulate matter from fireworks.

#### 2.5.5 Group 5 – Summary of February 27, 2024, Mexico/Central America (Wildfire Smoke) $PM_{2.5}$ Event at the Webberville Monitor

On February 27, 2024, hourly $PM_{2.5}$ concentrations peaked at 31.8 µg/m3 (8:00 pm (CST)) as shown in Figure 2-7: *Hourly $PM_{2.5}$ Concentrations on Days around Event (February 27, 2024) at* the *Webberville Monitor*, due to smoke from fires in Mexico. Figure 2-8: *Percentage of Reported Fire Instances by the Mexican Government, on and around February 27, 2024*, shows the causes of reported fires in Mexico, at least 38% are unlikely to recur (intentional).

The 500 mb chart (Figure A-20) for February 27, 2024, shows a longwave trough over the western U.S. with a cutoff low-height center off the coast of Southern California. There was also a 500 mb ridging over the central U.S. and Texas with winds from the southwest at this level. On the surface chart (Figure A-19), the pressure gradient is oriented from the west to the south over Texas, with winds coming from the south. These southerly winds at the surface aided the transport of smoke from Mexico to the Webberville monitor as light to moderate smoke can be seen traveling towards the monitor on NOAA HMS (Figure A-21) with heavy fire points in Mexico.

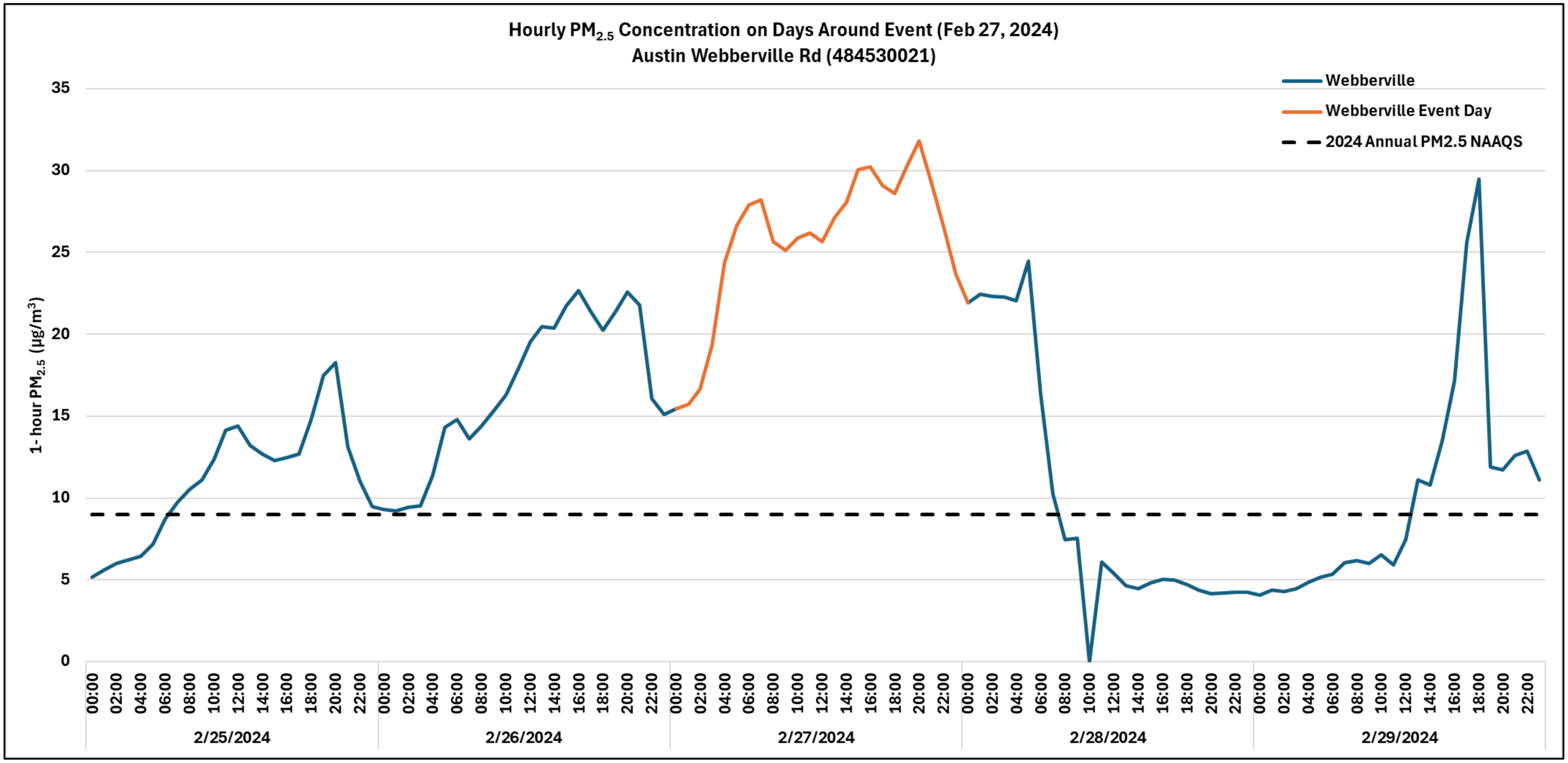


**Figure 2-7: Hourly $PM_{2.5}$ Concentrations on Days around Event (February 27, 2024) at the Webberville Monitor**

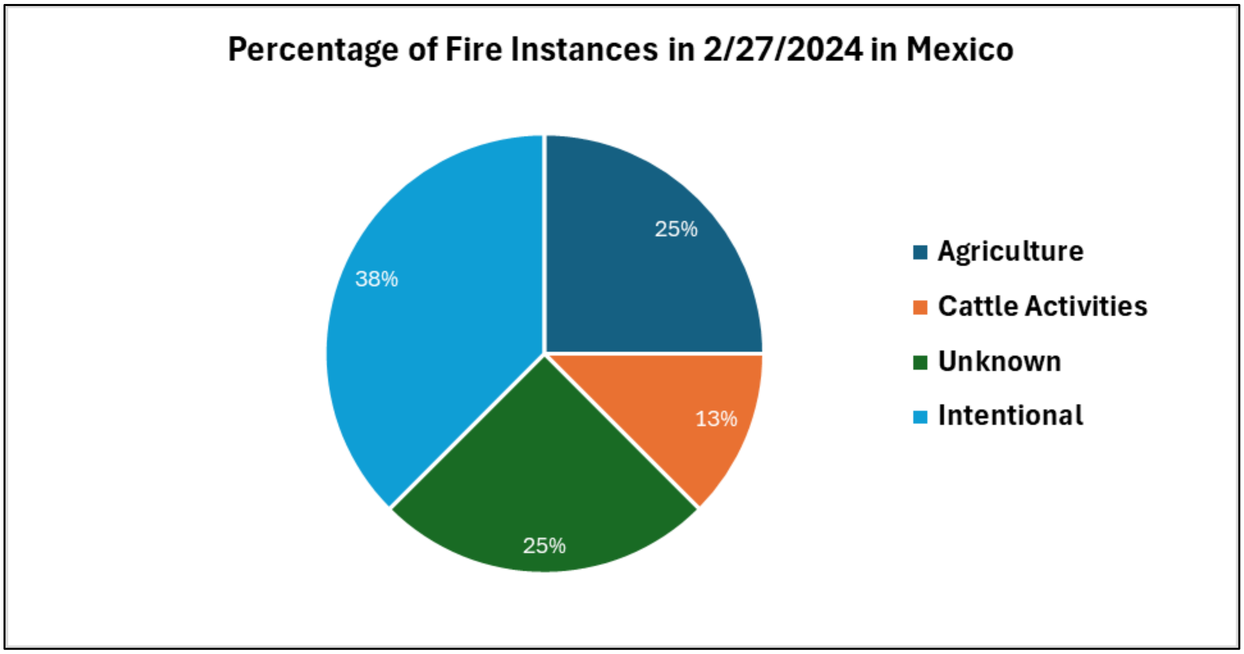


**Figure 2-8: Percentage of Reported Fire Instances by the Mexican Government, on and around February 27, 2024**

### 2.5.6 Group 6 - Summary of April 1, 2024, Fire (Mexico/Central America) $PM_{2.5}$ Event for the National Seashore and Webberville Monitors

Wildfire smoke from fires in Mexico affected the National Seashore and Webberville monitoring sites on April 1, 2024. Average daily $PM_{2.5}$ concentrations at the Webberville and National Seashore reached 34.2 µg/m³ and 25.2 µg/m³ respectively. Figure 2-9: *Hourly $PM_{2.5}$ Concentrations on Days around Event (April 1, 2024) at the National Seashore and Webberville Monitors*, shows the time series of hourly $PM_{2.5}$ concentrations at both monitors. The peak hourly concentrations were 76.8 µg/m³ and 76.2 µg/m³ at Webberville and National Seashore, respectively.

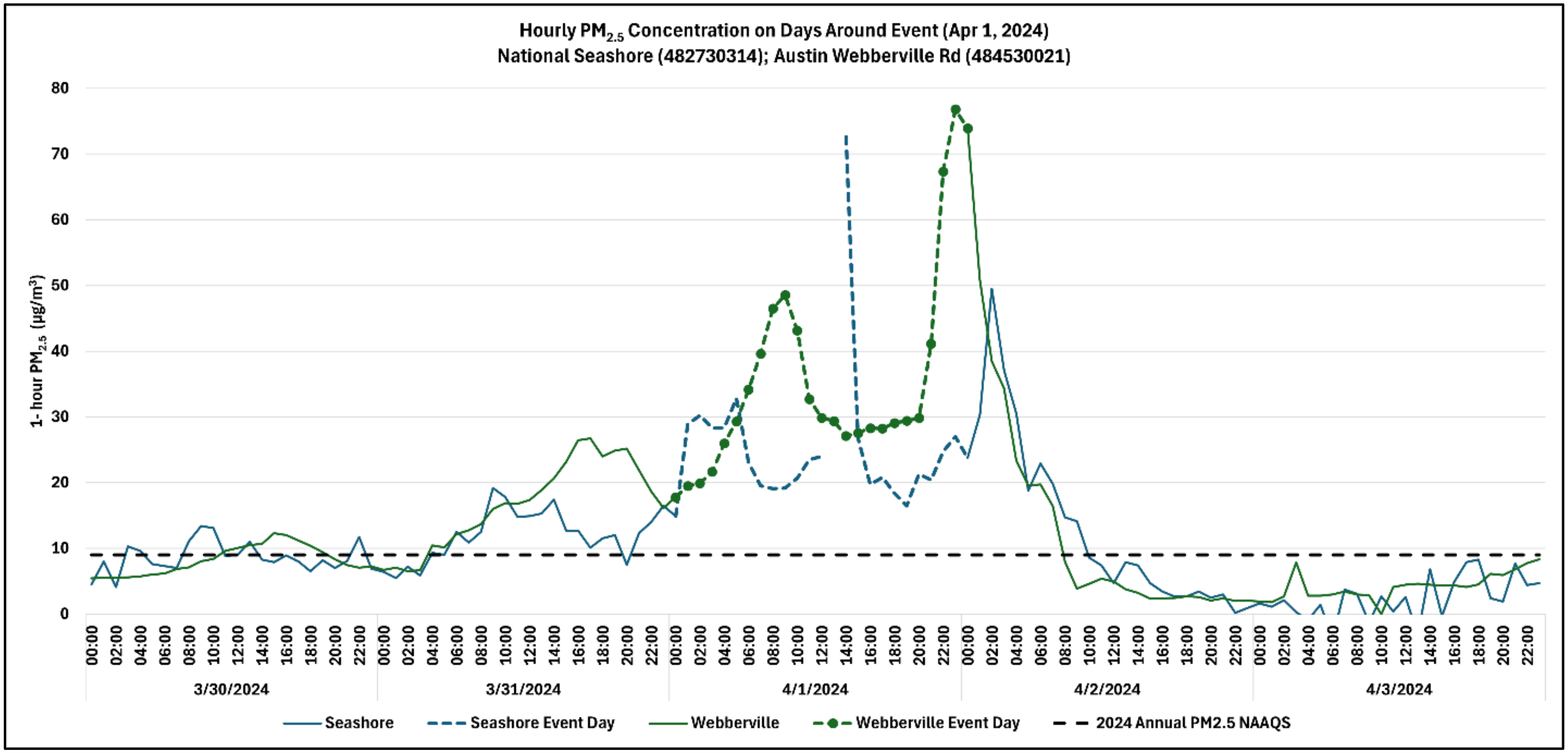

Figure 2-9: Hourly $PM_{2.5}$ Concentrations on Days around Event (April 1, 2024) at the National Seashore and Webberville Monitors

Figure 2-10: *Percentage of Reported Fire Instances by the Mexican Government, on and around April 1, 2024*, shows the causes of reported fires in Mexico, at least 40% are unlikely to recur (campfires and intentional).

On April 1, 2024, there was longwave troughing at 500 mb over the western U.S. with ridging over Texas (Figure A-23). The winds were from the southwest at this level showing speeds up to 70 knots, indicating a jet stream at 300 mb. On the surface chart (Figure A-22), winds were from the south, aiding the transport of smoke from Central American fires to the Webberville and National Seashore monitors. Light to moderate smoke can be seen on the area on HMS smoke map (Figure A-24 and A-25) with heavy fire points in Mexico.

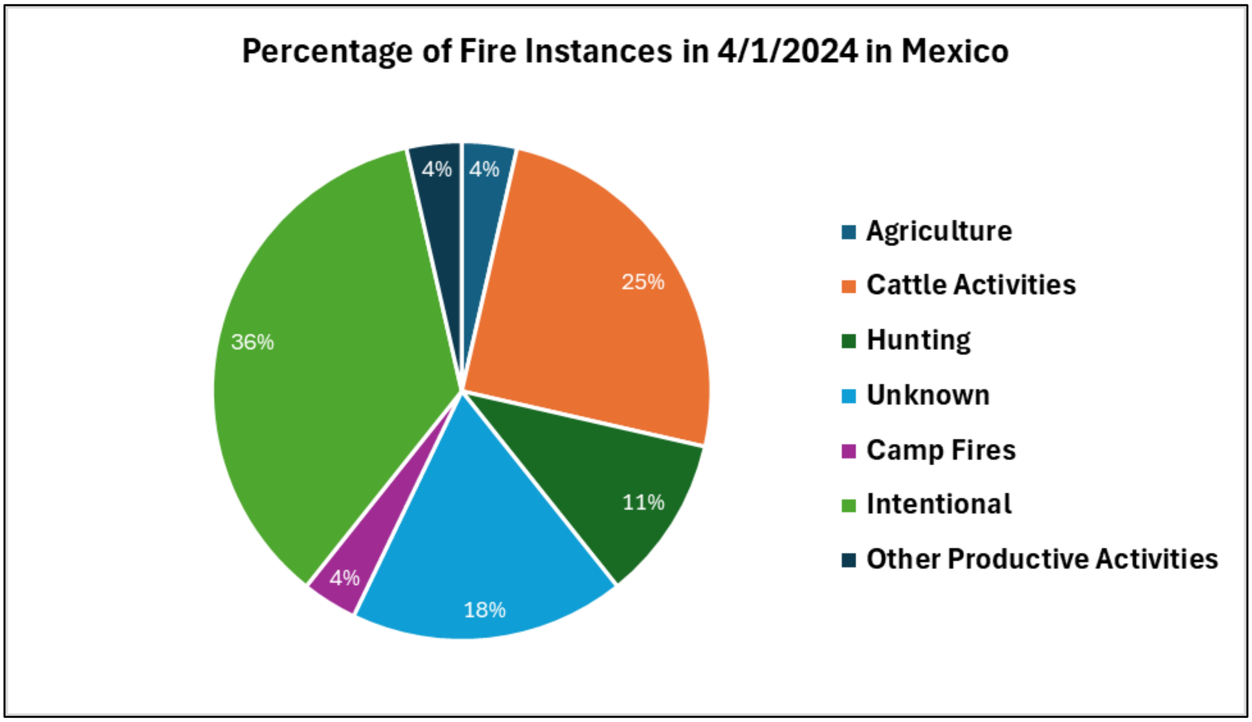


**Figure 2-10: Percentage of Reported Fire Instances by the Mexican Government, on and around April 1, 2024**

### 2.5.7 Group 7 – Summary of April 4 through 6, 2024, Prescribed Fire $PM_{2.5}$ Event for the Karnack Monitor

Daily $PM_{2.5}$ averages at the Karnack site measured 129.1 µg/m$^3$, 188.1 µg/m$^3$, and 80.2 µg/m$^3$ on April 4 through 6, 2024, respectively (Figure 2-11: *Hourly $PM_{2.5}$ Concentrations on Days around Event (April 4 through 6, 2024) at the Karnack Monitor*).

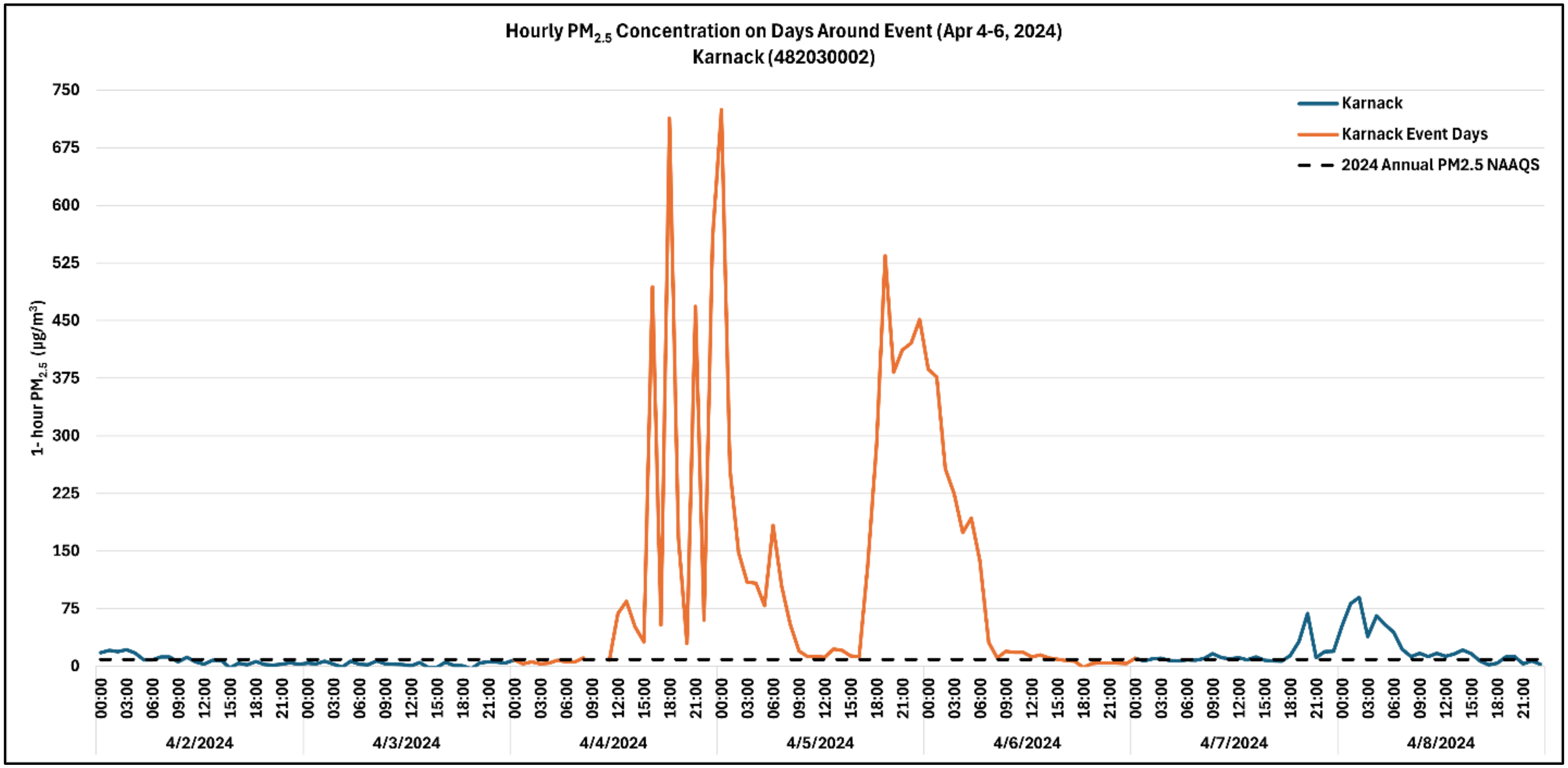

**Figure 2-11: Hourly $PM_{2.5}$ Concentrations on Days around Event (April 4 through 6, 2024) at the Karnack Monitor**

On April 4, 2024, the 500 mb pattern (Figure A-27) exhibited a classic omega block with two cutoff low height centers flanking a high height center over Canada. There was strong ridging over the central U.S. and Texas creating a flow from the northwest over northeast Texas at the 500 mb level. This flow facilitated the transport of particulate matter from Canadian wildfires upstream of the Karnack monitor. This was due to the blocking pattern over the U.S. remaining stationary from April 4 through April 6, 2024, keeping the flow over the Karnack monitor from the northwest on those days. Additionally, the upper atmosphere transport of $PM_{2.5}$ was likely brought towards the surface at the Karnack monitor site due to high pressure and subsidence over Texas. The possibility of local prescribed fires nearby may have also contributed to the $PM_{2.5}$ exceedance event at the Karnack monitor. The weather observations from East Texas Regional Airport station showed no significant weather with light winds on April 4, 2024. The sounding from Shreveport (Figure A-28) shows a strong radiation inversion in the morning, and an absolutely stable atmosphere, which limits vertical movement of air. The atmosphere is considered absolutely stable due to the temperature decreasing with height at a slower rate than both the dry and moist adiabatic lapse rates. This effect impeded the dissipation of any nearby smoke plumes, keeping the particulate matter near the surface. These conditions remained through April 5, 2024, while April 6, 2024, saw an increase in wind speeds, with nearly 30 knot gusts. While the $PM_{2.5}$ concentration on April 6, 2024, still exceeded 80 μg/$m^3$, this was less than half the concentration of the previous two days. This decrease in concentration was likely due to increased dissipation from the higher winds and conditionally unstable atmosphere, as seen in the Shreveport sounding on April 6, 2024. Moderate smoke can be seen over the area on NOAA HMS maps (Figure A-29 through A-31) with heavy fire points.

### 2.5.8 Group 8 – Summary of the April 17, 2024, and April 18, 2024, Fire (Mexico/Central America) $PM_{2.5}$ Event for the Webberville Monitor

On April 17 and 18, 2024, daily average $PM_{2.5}$ concentrations at the Webberville monitoring site reached 23.8 μg/$m^3$ and 24.6 μg/$m^3$ due to smoke from fires in Mexico. The time series of hourly $PM_{2.5}$ concentrations is shown in Figure 2-12: *Hourly $PM_{2.5}$ Concentrations on Days around Event (April 17, 2024, and April 18,* 2024*) at the Webberville Monitor.*

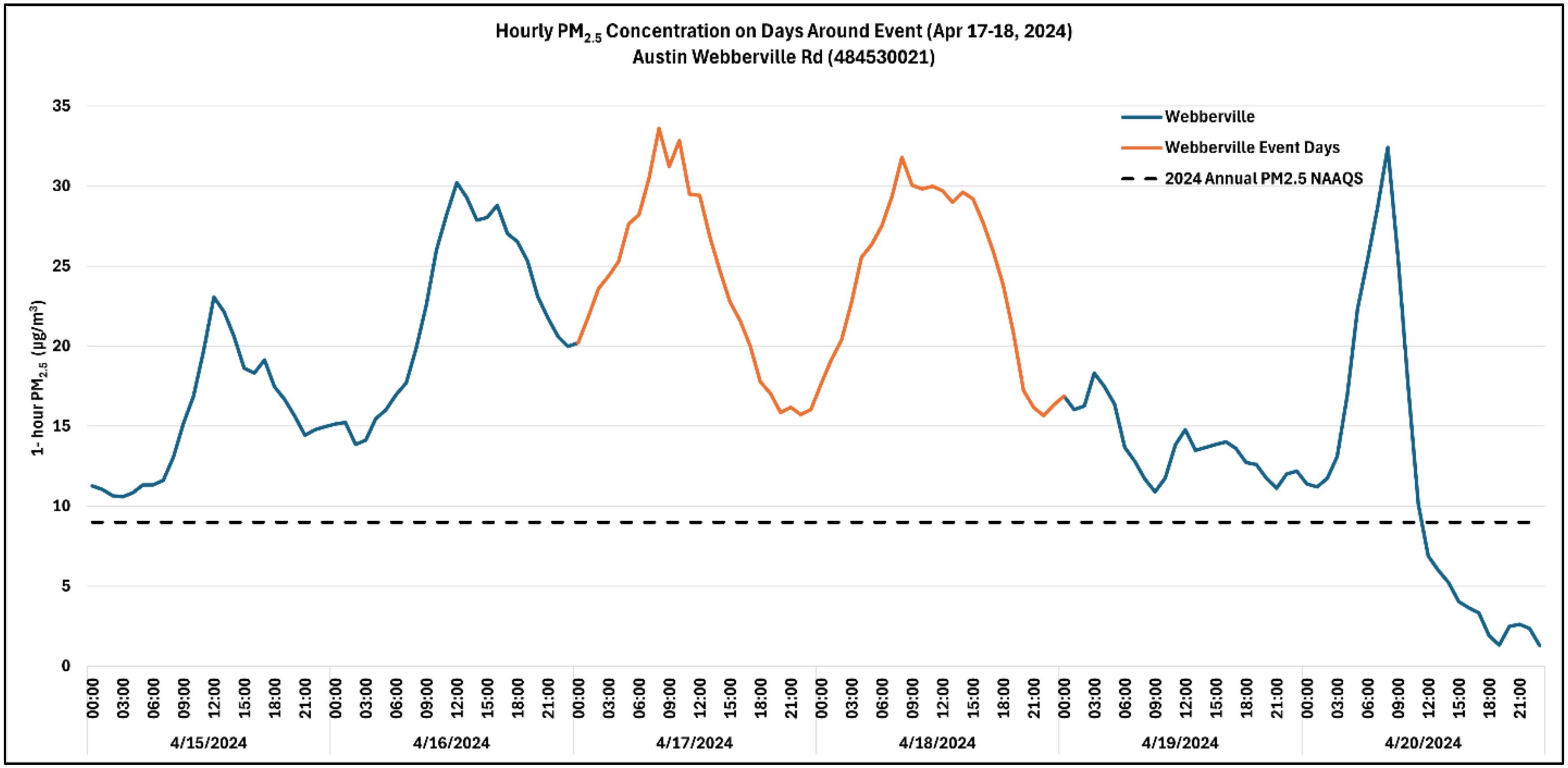

Figure 2-12: Hourly $PM_{2.5}$ Concentrations on Days around Event (April 17, 2024, and April 18, 2024) at the Webberville Monitor

On April 17, 2024, there was 500 mb troughing over the western and central U.S (Figure A-32 and Figure A-33). This troughing brought southwesterly wind flow over Texas. This enabled the transportation of smoke from Mexican fires to the Webberville monitor, as seen in NOAA HMS smoke map (Figure A-34), with heavy fire points in Mexico area. This pattern remained in place over the U.S. on April 18, 2024, as well, continuing the transport of smoke to the Austin area (Figure A-35).

Figure 2-13: *Percentage of Reported Fire Instances by the Mexican Government, on and around April 17, 2024, and April 18, 2024*, shows the causes of reported fires in Mexico, at least 39% are unlikely to recur (smokers and intentional).

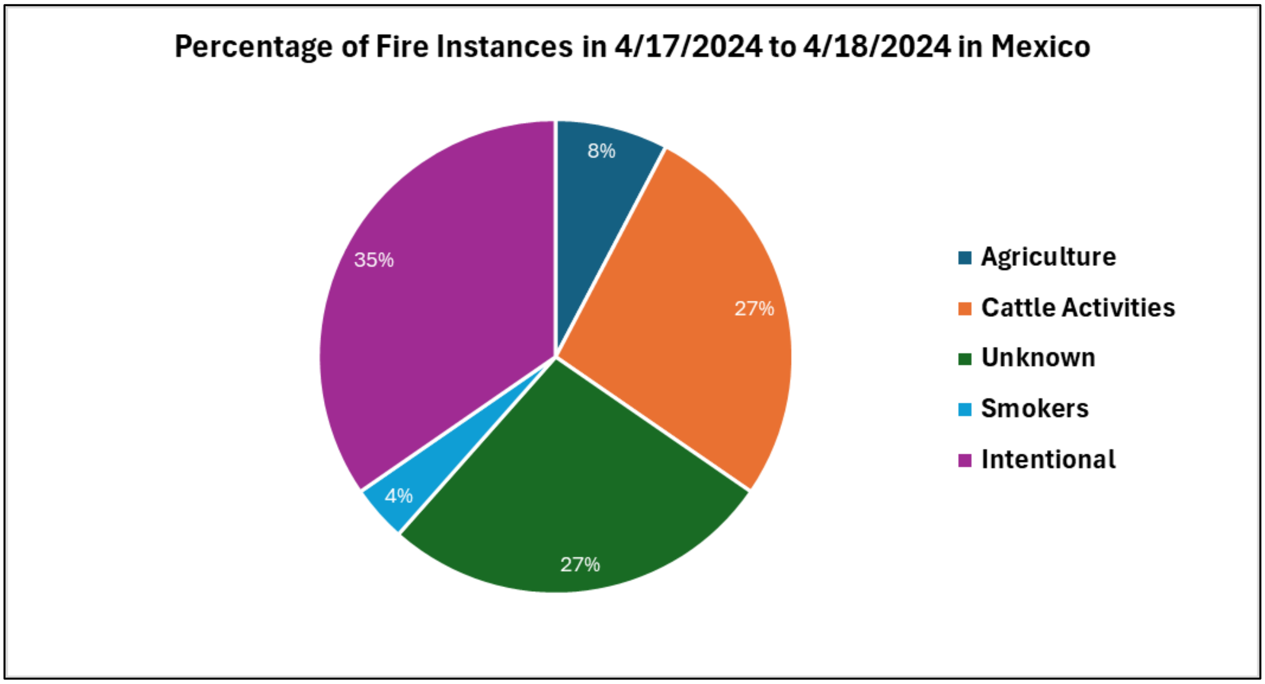


**Figure 2-13: Percentage of Reported Fire Instances by the Mexican Government, on and around April 17, 2024, and April 18, 2024**

### 2.5.9 Group 9 – Summary of April 26, 2024, through April 28, 2024, Fire (Mexico/Central America) $PM_{2.5}$ Event for the National Seashore and Webberville Monitors

The Webberville monitor was affected on April 26 and April 27, 2024, and the National Seashore monitor on April 27 and April 28, 2024, due to smoke from fires from Mexico. The time series of hourly $PM_{2.5}$ concentrations is shown in Figure 2-14: *Hourly $PM_{2.5}$ Concentrations on Days around Event (April 26, through April 28, 2024) at the Webberville and National Seashore Monitors.*

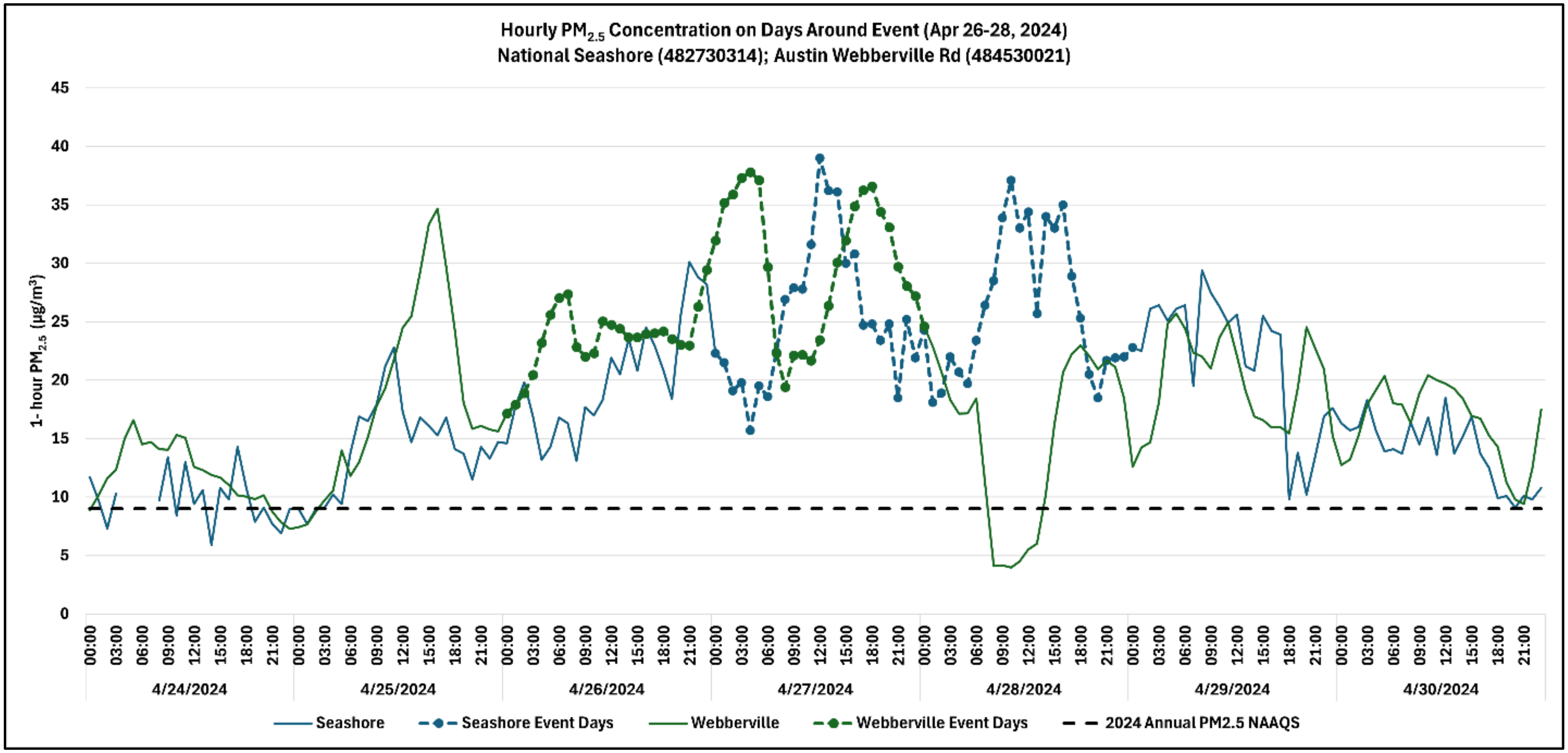


**Figure 2-14: Hourly $PM_{2.5}$ Concentrations on Days around Event (April 26, through April 28, 2024) at the Webberville and National Seashore Monitors**

On April 27, 2024 (Figure A-36 and A-37), there was 500 mb troughing over the Rockies and ridging over the eastern U.S. This pattern led to wind flow from the southwest across Texas allowing the transport of smoke from Mexican fires to the National Seashore and Webberville monitors, as seen in NOAA HMS map (Figure A-38 through A-40). The pattern on April 28, 2024, shifted slightly, but flow over the Texas coast was still from the southwest, continuing to bring smoke to the National Seashore monitor (Figure A-41).

Figure 2-15: *Percentage of Reported Fire Instances by the Mexican Government, on and around April 26, 2024, through April 28, 2024*, shows the causes of reported fires in Mexico, half of which are unlikely to recur (hunting, smokers and intentional).

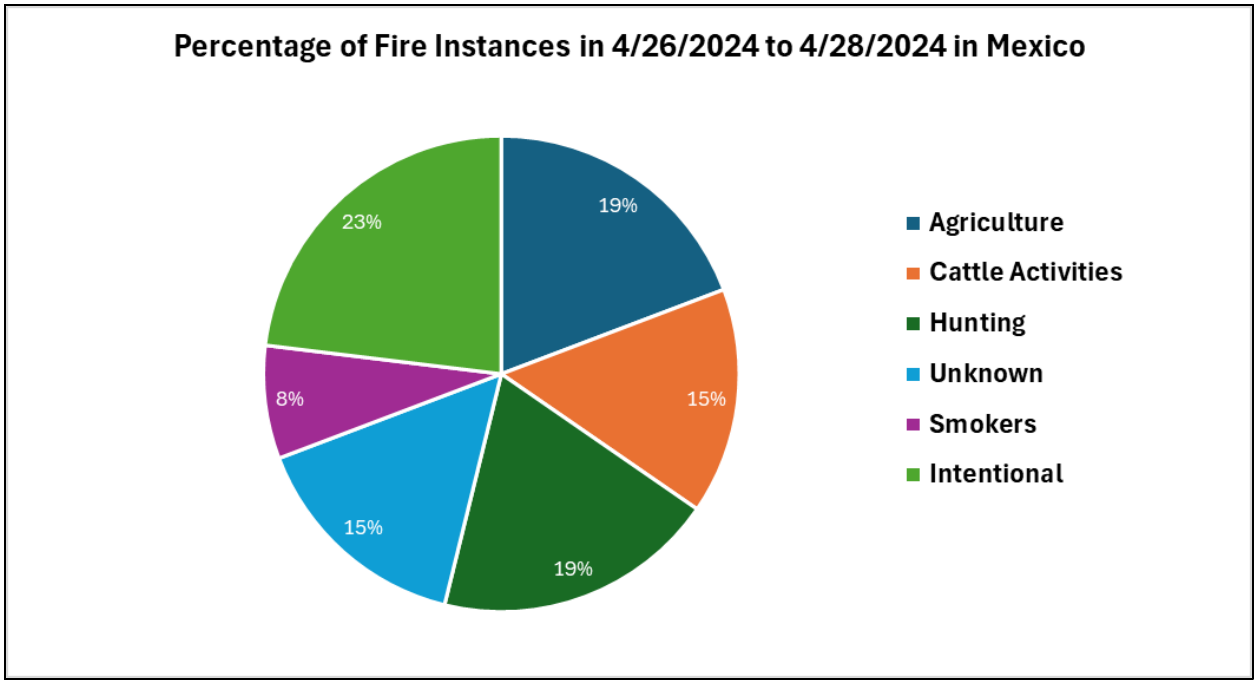


**Figure 2-15: Percentage of Reported Fire Instances by the Mexican Government, on and around April 26, 2024, through April 28, 2024**

### 2.5.10 Group 10 – Summary of May 7, 2024, through May 10, 2024, Fire (Mexico/Central America) $PM_{2.5}$ Event for the National Seashore, North Hills and Webberville Monitors

From May 7 through May 10, 2024, the Austin and Corpus Christi areas experienced exceptional events tied to fires in Mexico. The Webberville monitor had $PM_{2.5}$ daily averages of 28.5, 51.8, and 35.6 µg/$m^3$ on May 7 through May 9, 2024. The National Seashore monitor had daily averages of 32.8, 43.7, and 36 µg/$m^3$ on May 8 through May 10, 2024. The Austin North Hills monitor had a daily $PM_{2.5}$ average of 43.1 µg/$m^3$ on May 8, 2024. The time series of hourly $PM_{2.5}$ concentrations for all three monitors is shown in Figure 2-16: *Hourly $PM_{2.5}$ Concentrations on Days around Event (May 7, 2024, through May 10, 2024) at the National Seashore, North Hills and Webberville Monitors.*

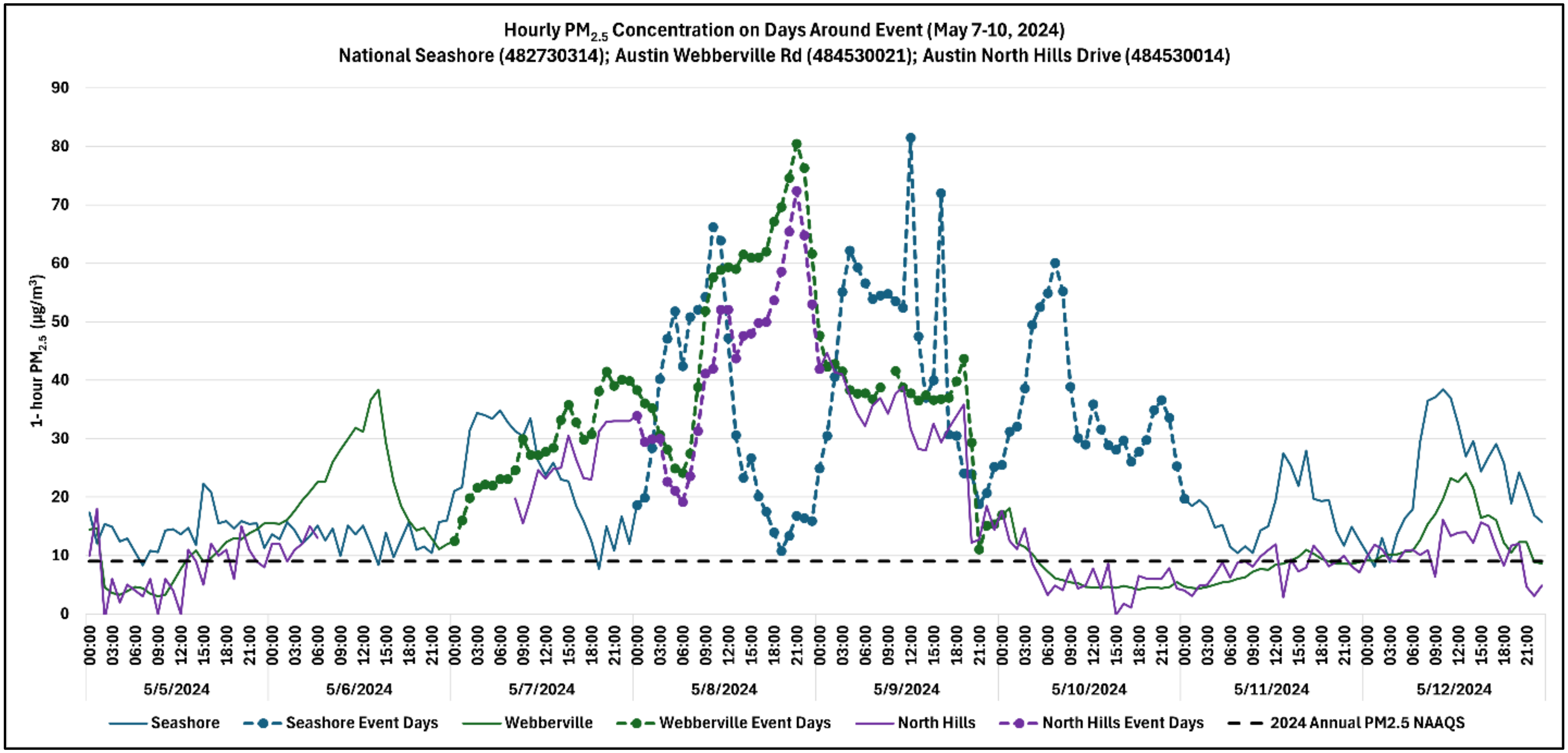


**Figure 2-16: Hourly $PM_{2.5}$ Concentrations on Days around Event (May 7, 2024, through May 10, 2024) at the National Seashore, North Hills and Webberville Monitors**

On May 7, 2024, there was longwave troughing at 500 mb over the central U.S. that stacked down to a low-pressure center over North and South Dakota. This trough created winds from the southwest over Texas that enabled the transport of smoke from Central American fires to monitors in South Texas (Figures A-42 and A-43). Throughout the rest of the week, the low-pressure center weakened and moved downstream, however, the flow at 500 mb over Texas remained from the southwest. Light to moderate smoke can be seen over the areas during the event days on NOAA HMS map (Figure A-44 through A-47), with heavy fire points in Mexico area.

Figure 2-17: *Percentage of Reported Fire Instances by the Mexican Government, on and around May 7, 2024, through May 15, 2024*, shows the causes of reported fires in Mexico, half of which are unlikely to recur (hunting, campfires, natural, smokers and intentional).

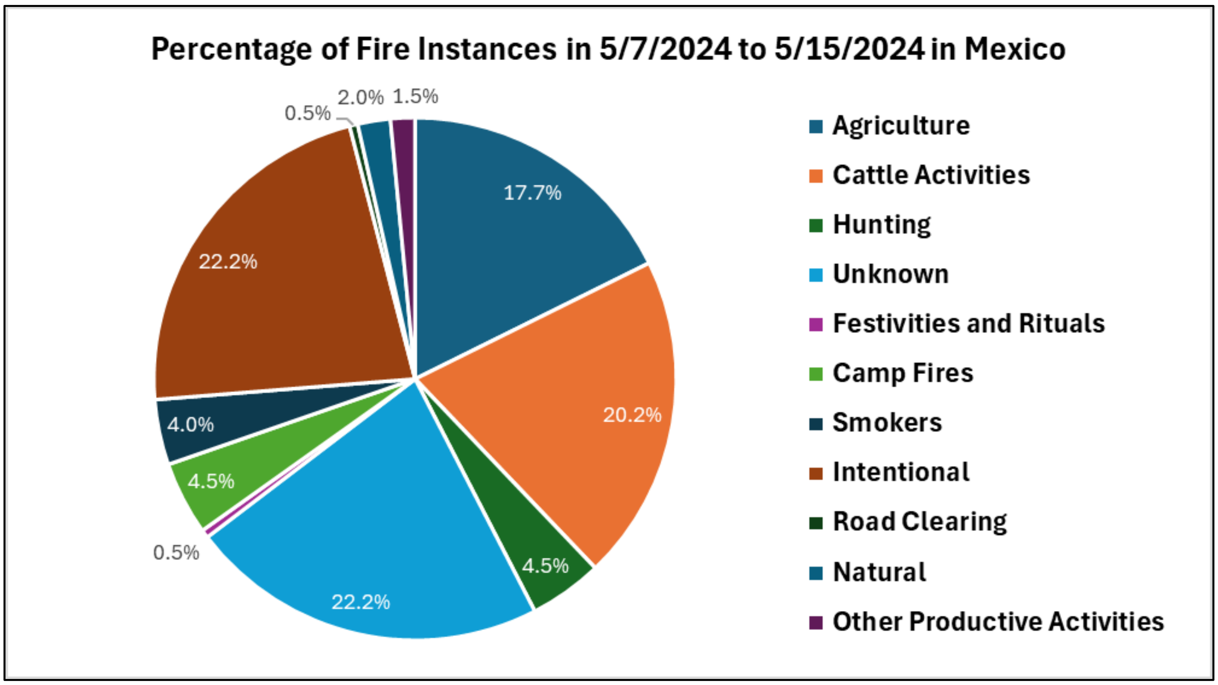


**Figure 2-17: Percentage of Reported Fire Instances by the Mexican Government, on and around May 7, 2024, through May 15, 2024**

### 2.5.11 Group 11 – Summary of May 16, 2024, Fire (Mexico/Central America) $PM_{2.5}$ Event for the National Seashore Monitor

On May 16, 2024, the National Seashore monitor experienced a daily $PM_{2.5}$ average of 33.3 µg/$m^3$ due to smoke from fires in Mexico. The time series for this day is shown in Figure 2-18: *Hourly $PM_{2.5}$ Concentrations on Days around Event (May 16, 2024) at the National Seashore Monitor*.

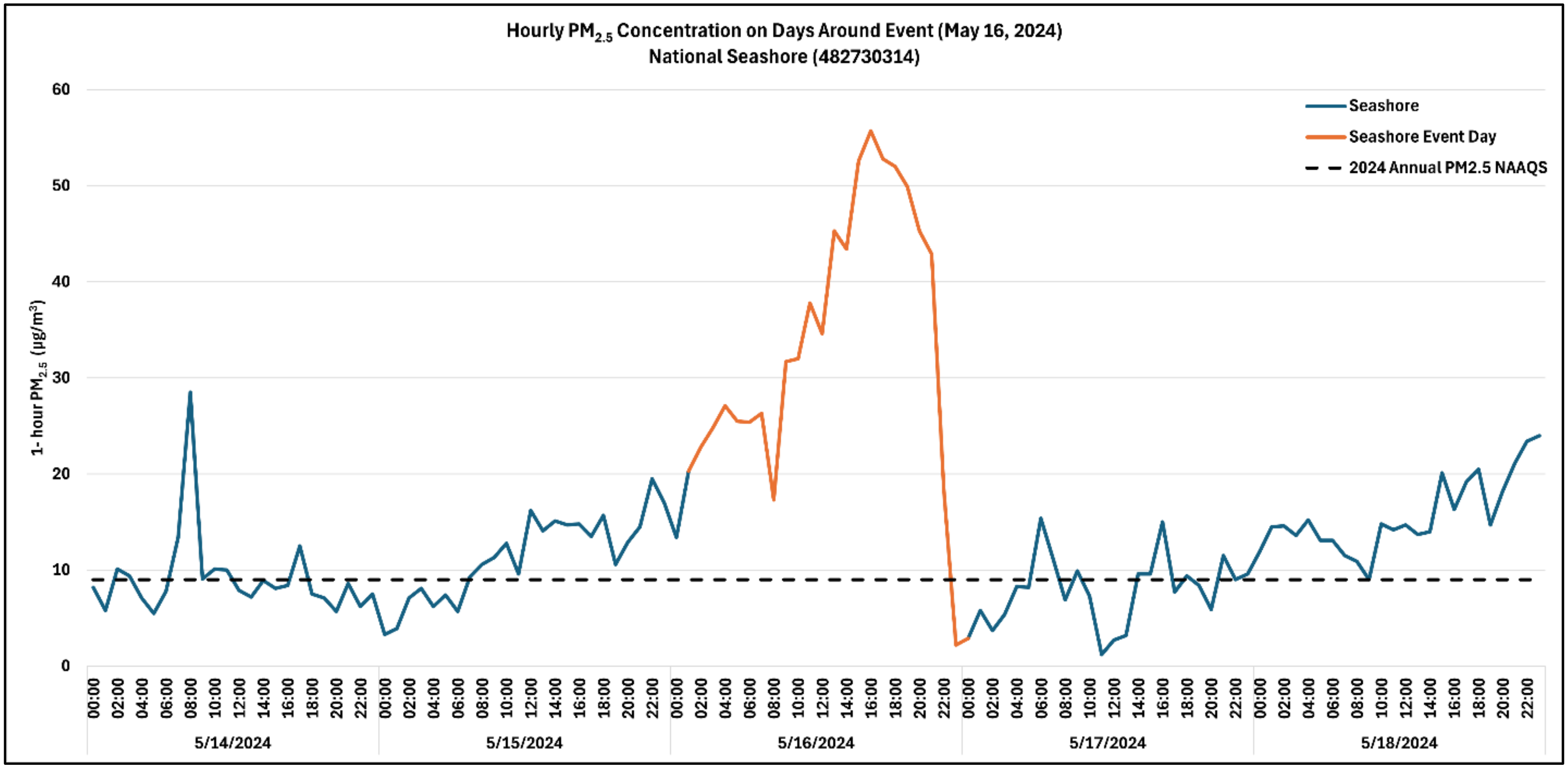


**Figure 2-18: Hourly $PM_{2.5}$ Concentrations on Days around Event (May 16, 2024) at the National Seashore Monitor**

On May 15, 2024, there was weak 500 mb ridging over Texas with winds from the west over southern Texas and winds from the northwest in East Texas (Figure A-47 and A-48). This led to particulate matter being transported from Mexican fires to South Texas. While these winds enabled the transport of smoke in the upper atmosphere to Texas, ridging and higher pressure created subsidence that pushed the particulate matter towards the surface, as seen in NOAA HMS map (Figure A-50), with heavy fire points in Mexico.

Figure 2-19: *Percentage of Reported Fire Instances by the Mexican Government, on and around May 16, 2024, through May 30, 2024*, shows the causes of reported fires in Mexico, half of which are unlikely to recur (hunting, campfires, natural, smokers and intentional).

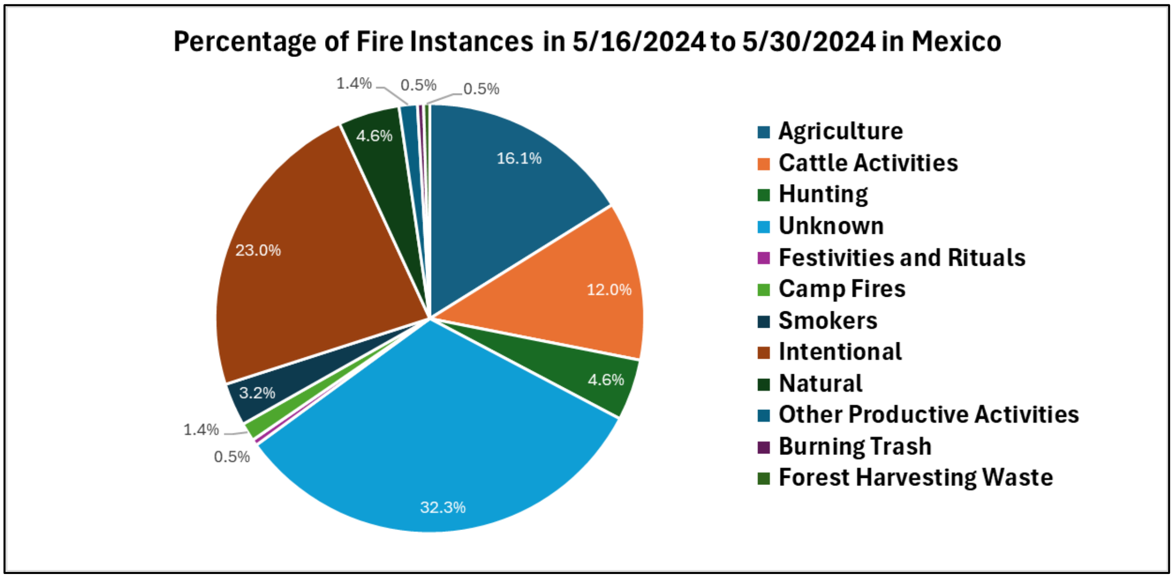


**Figure 2-19: Percentage of Reported Fire Instances by the Mexican Government, on and around May 16, 2024, through May 30, 2024**

### 2.5.12 Group 12 – Summary of May 19, through May 28, 2024, Fire (Mexico/Central America) $PM_{2.5}$ Event for the National Seashore and Webberville Monitors

The exceptional events in this group were caused by smoke from wildfires in Mexico. The exceedance concentrations for the individual events are summarized in Table 2-1: *Maximum Daily $PM_{2.5}$ Averages for Exceptional Days in Group 12*. The time series of hourly $PM_{2.5}$ concentrations for all three monitors is shown in *Figure 2-20: Hourly $PM_{2.5}$ Concentrations on Days around Event (May 19 through May 28, 2024) at the National Seashore and Webberville Monitors*. As seen in Figure 2-19, more than half of the reported fires are unlikely to recur (hunting, campfires, natural, smokers, and intentional).

**Table 2-1: Maximum Daily $PM_{2.5}$ Averages for Exceptional Days in Group 12**

| Date | Site Name | Exceedance Concentration | Tier |
|---|---|---|---|
| 05/19/24 | National Seashore | 25.1 | 2 |
| 05/20/24 | National Seashore | 24.9 | 2 |
| 05/21/24 | Webberville | 31.3 | 1 |
| 05/21/24 | National Seashore | 31.4 | 1 |
| 05/22/24 | Webberville | 31.6 | 1 |

| Date | Site Name | Exceedance Concentration | Tier |
|---|---|---|---|
| 05/23/24 | Webberville | 25.2 | 2 |
| 05/23/24 | National Seashore | 28.7 | 1 |
| 05/24/24 | Webberville | 33.8 | 1 |
| 05/24/24 | National Seashore | 28.4 | 1 |
| 05/25/24 | Webberville | 32.8 | 1 |
| 05/25/24 | National Seashore | 28.4 | 1 |
| 05/26/24 | Webberville | 35.6 | 1 |
| 05/26/24 | National Seashore | 33.3 | 1 |
| 05/27/24 | Webberville | 41.7 | 1 |
| 05/27/24 | National Seashore | 38 | 1 |
| 05/28/24 | National Seashore | 25.1 | 2 |

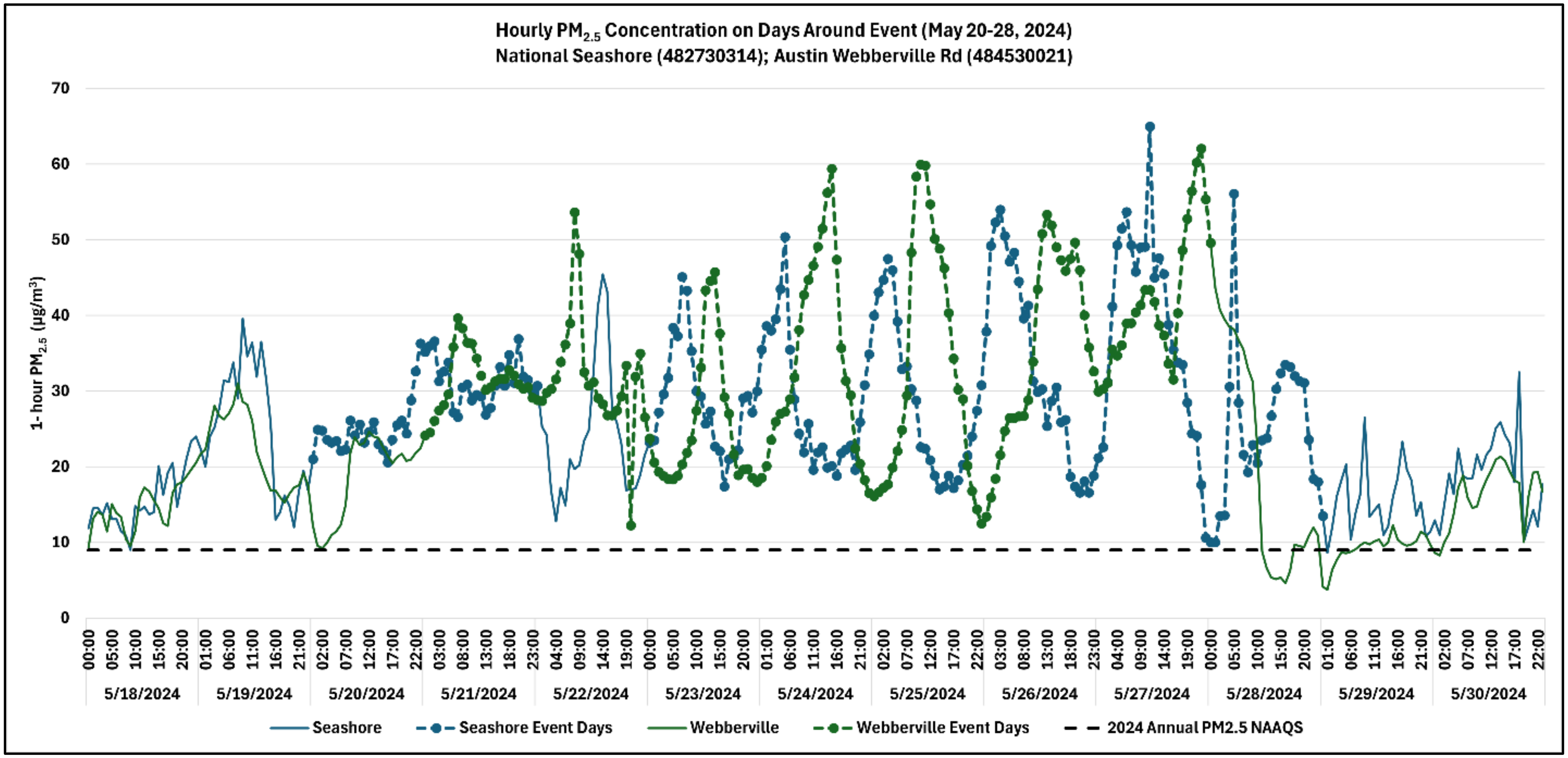

Figure 2-20: Hourly $PM_{2.5}$ Concentrations on Days around Event (May 19 through May 28, 2024) at the National Seashore and Webberville Monitors

On May 18, 2024, the longwave pattern at 500 mb over the U.S. showed troughing over the west, with a ridge over the east. There was a major shortwave trough over eastern Texas at this level, but the flow was from the southwest over South Texas and Central Texas where the affected monitor sites are located (Figure A-51 and A-52). This flow facilitated the transport of smoke from fires in Mexico to the National Seashore and Webberville monitoring sites. Throughout the next week (Figure A-53 and A-54), the pattern shifted as both the longwave trough and major shortwave troughs moved downstream however, the flow over southern Texas remained from the southwest at 500 mb. By May 28, 2024 (Figure A-55 and A-56), ridging had progressed over the western U.S. and Texas with high heights over southern Texas and Mexico, bringing subsidence. This subsidence likely pushed any particulate matter in the upper atmosphere towards the surface and kept any residual pollutants from dissipating upward. Moderate to heavy smoke can be seen over the Gulf of America on May 19, 2024, with light to moderate smoke on the remaining event days over the monitors, as seen on NOAA HMS Smoke map (Figure A-57 through A-66), with heavy fire points in Mexico.

### 2.5.13 Group 13 – Summary of June 3 through June 6, 2024, Fire (Mexico/Central America) $PM_{2.5}$ Event for the National Seashore and Webberville Monitors

On June 3 through June 6, 2024, the National Seashore monitor experienced average daily $PM_{2.5}$ concentrations of 25.6 µg/$m^3$, 30.6 µg/$m^3$, 35.7 µg/$m^3$, and 27.4 µg/$m^3$ respectively. On June 4, 2024, the Webberville monitor had a $PM_{2.5}$ daily average of 32.3 µg/$m^3$. Figure 2-21: *Hourly $PM_{2.5}$ Concentrations on Days around Event (June 3 through June 6, 2024) at the National Seashore and Webberville Monitors* shows the hourly $PM_{2.5}$ concentrations at the National Seashore and Webberville monitors before, during, and after the event. The events in this time period were primarily caused by smoke from fires in Mexico. Additionally, high winds (five-minute winds greater than 25 miles per hour for more than five hours) also contributed to high concentrations of $PM_{2.5}$ at the National Seashore monitor on June 5, 2024.

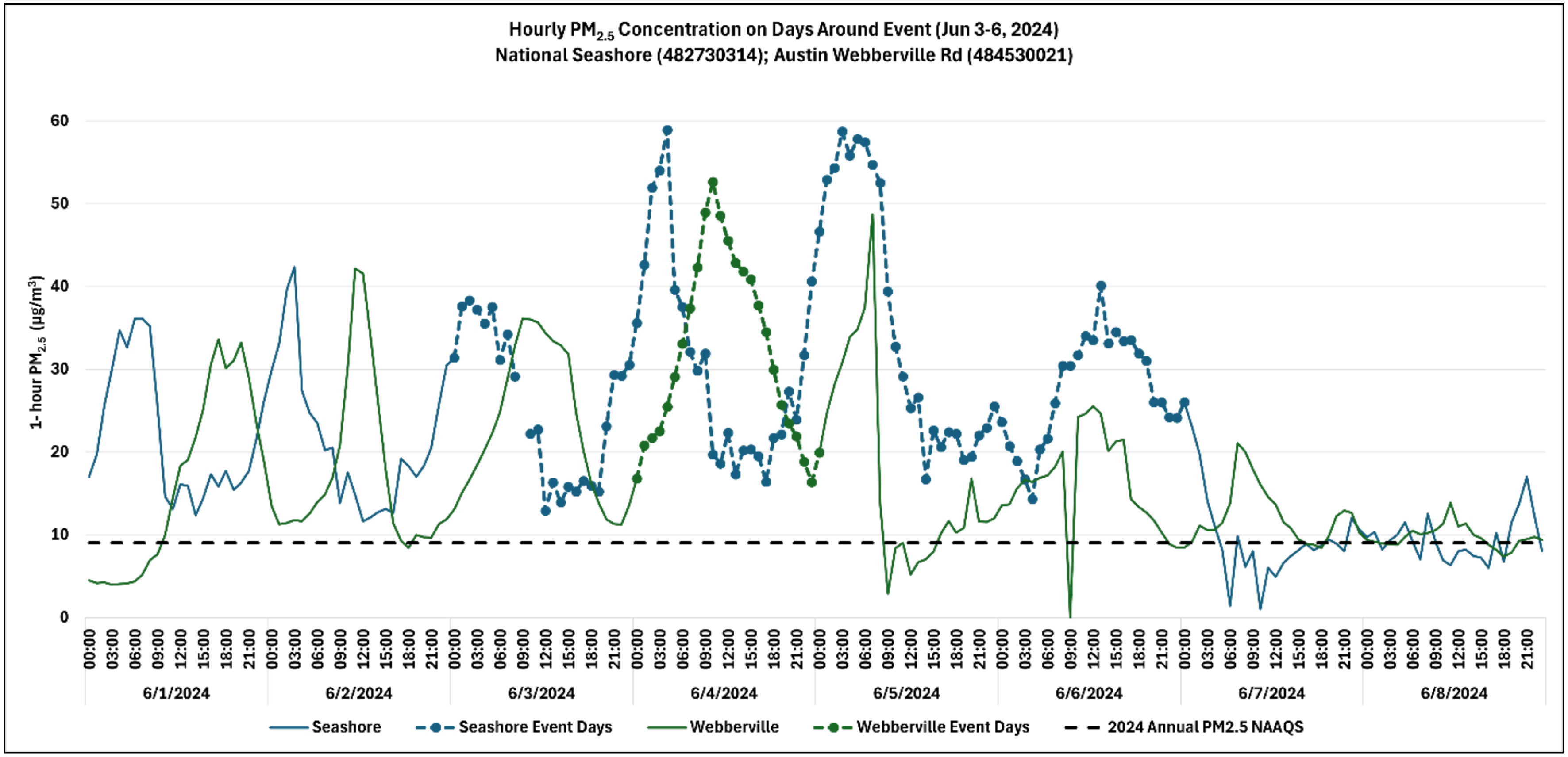


Figure 2-21: Hourly $PM_{2.5}$ Concentrations on Days around Event (June 3 through June 6, 2024) at the National Seashore and Webberville Monitors

On June 2 through June 4, 2024, southern Texas experienced hot and humid conditions with moderate surface winds largely out of the south, with some variation from the southwest and southeast (Figure A-67 through A-69). A dryline extended from the panhandle area south towards Laredo, Texas. On June 5, 2024, a cold front briefly approached the region from the north before retreating on June 6, 2024, as high pressure regained control of the area (Figure A-70 and A-71).

On June 2 through June 4, 2024, at the mid-levels of the atmosphere, the winds were moderate flowing generally from the west to the east over southern Texas (Figure A-72 through A-74). This helped to transport smoke from fires in northern Mexico into southern and central Texas. On June 5 and 6, 2024, a mid-level ridge settled into the area, increasing subsidence and trapping particulate matter close to the surface level (Figure A-75 and Figure A-76). The combined smoke transport and subsidence, as well as the high humidity in the area, resulted in elevated $PM_{2.5}$ concentrations in southern and central Texas during this period. Light to moderate smoke can be seen over the Gulf of America and monitor area on the NOAA HMS Smoke maps (Figure A-77 through Figure A-79), with fire points in Mexico. Figure 2-22: *Percentage of Reported Fire Instances by the Mexican Government, on and around June 3, 2024, through June 6, 2024*, shows the causes of reported fires in Mexico, 39% of which are unlikely to recur (hunting, campfires, natural, forest harvesting waste, smokers and intentional).

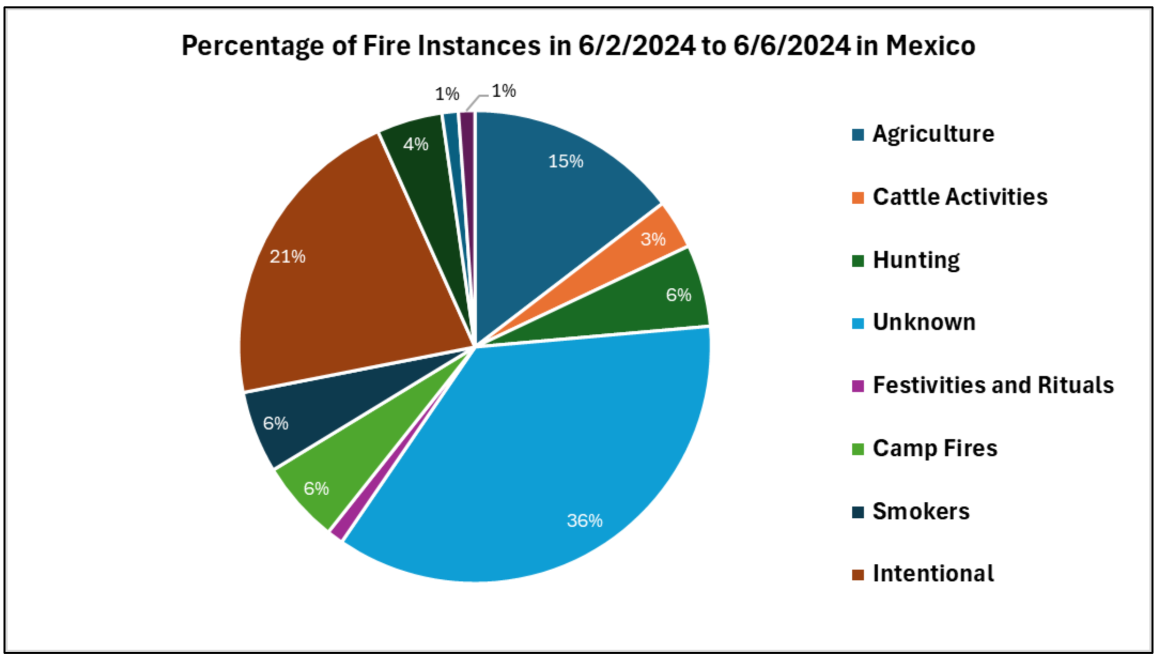


**Figure 2-22: Percentage of Reported Fire Instances by the Mexican Government, on and around June 3, 2024, through June 6, 2024**

### 2.5.14 Group 14 – Summary of July 30 through August 1, 2024, African Dust $PM_{2.5}$ Event for the National Seashore and Webberville Monitors

On July 30, 2024, the National Seashore monitor experienced a daily $PM_{2.5}$ average of 25.0 µg/$m^3$. On July 31, 2024, the Webberville monitor experienced a daily $PM_{2.5}$ average of 37.5 µg/$m^3$, and the National Seashore monitor experienced a daily $PM_{2.5}$ average of 34.1 µg/$m^3$. On August 1, 2024, the Webberville monitor experienced a daily $PM_{2.5}$ average of 29.0 µg/$m^3$. These events are attributable to dust transported from Africa (Figure 2-23: *Hourly $PM_{2.5}$ Concentrations on Days around Event (July 30 through August 1, 2024) at the National Seashore and Webberville Monitor*).

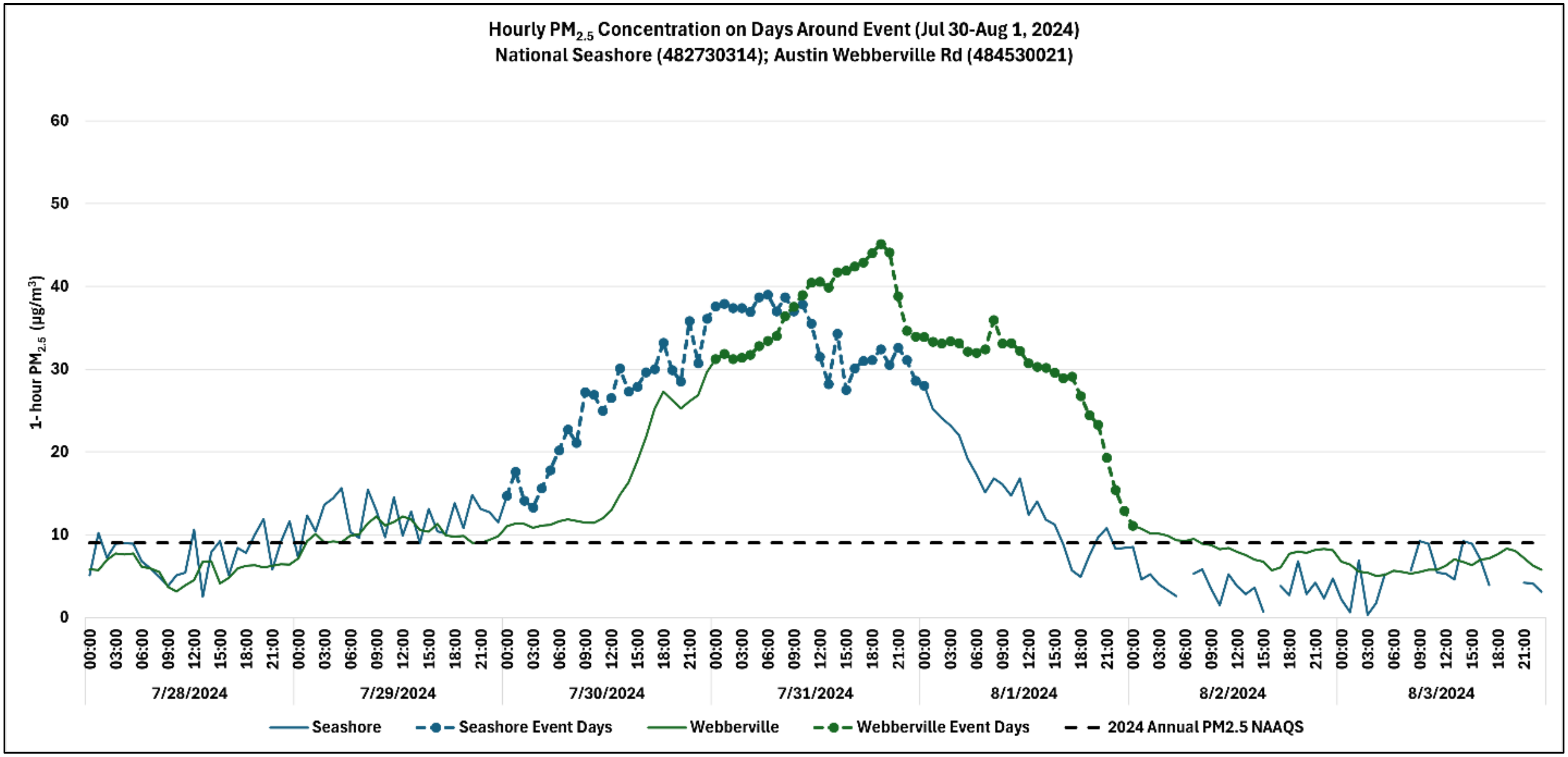


**Figure 2-23: Hourly $PM_{2.5}$ Concentrations on Days around Event (July 30 through August 1, 2024) at the National Seashore and Webberville Monitor**

July 30 through August 1, 2024, depicted the typical pattern seen with large African Dust events in Texas. Near the surface, there was onshore flow over much of the coast of Texas continuing with winds out of the south and southeast over much of the state (Figure A-80 through A-82). Similar conditions were present at the mid-levels with a broad area of high pressure centered over northern Texas (Figure A-83 through A-85). These conditions bring African dust west across the southern Gulf before moving north and northeast into Texas. The NWS forecasts from the Corpus Christi for July 30 and July 31, 2024, and Austin/San Antonio for July 31, 2024, (Figure B-14 and Figure B-15) discuss the presence of haze due to Saharan dust. As a result of this large, broad African Dust event, elevated $PM_{2.5}$ concentrations were measured in counties along the coast and further inland through central Texas.

# SECTION 3: CLEAR CAUSAL RELATIONSHIP

## 3.1 OVERVIEW

This section satisfies the Exceptional Events Rule Requirements at 40 CFR §50.14(c)(3)(iv)(B) and 40 CFR §50.14(c)(3)(iv)(C): "The event affected air quality in such a way that there exists a clear, causal relationship between the specific event and the monitored exceedance(s) or violations(s); and analyses comparing the claimed event-influenced concentrations to concentrations at the same monitoring site(s) at other times."

The analyses presented in this section vary depending on the event type (Prescribed Fire, Wildland Fire, African Dust, Fire Works Events, and High Winds Events) as well the tier level, based on observed concentrations, associated with each event day. The analyses include a comparison of the event-related concentration to historical concentrations, evidence that the emissions from the events were transported to the monitor, and evidence that the events related emissions affected the monitor.

TCEQ determined the tier levels for the event days using EPA's *$PM_{2.5}$ Tiering Tool - for Exceptional Events Analysis*.[7] Tiering thresholds, established for each site, are used to classify event days as Tier 1 or Tier 2 or Tier 3 days. All event days are Tier 1 or Tier 2 days.

- Tier 1 event days are those when monitored $PM_{2.5}$ exceedances or violations are clearly influenced by causal events. Tier 1 event days require fewer pieces of evidence to establish the clear causal relationship. This tier is associated with a $PM_{2.5}$ concentration that is greater than or equal to 1.5x the tiering threshold.
- Tier 2 event days are those with $PM_{2.5}$ concentrations that are less extreme than Tier 1 days but still higher than concentrations on most non-event related concentrations, typically between 1 to 1.5x the tiering threshold. Tier 2 event days require more evidence than Tier 1 days to establish the clear causal relationship.

The determination of the appropriate tiering level began with an analysis of the measured $PM_{2.5}$ air quality associated with the candidate event in relation to historical concentrations. Distinct high levels of monitored 24-hour $PM_{2.5}$ concentrations when compared to historical monthly or annual 24-hour levels of $PM_{2.5}$. TCEQ compared the concentration of each event day to the lesser value with all "Request Exclusion" (R) qualifiers excluded 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.

Figure 3-1: *24-Hour $PM_{2.5}$ Concentrations, Event days and Tier 1 and Tier 2 Thresholds the Karnack Monitor*, Figure 3-2: *24-Hour $PM_{2.5}$ Concentrations, Event days and Tier 1 and Tier 2 Thresholds for the Austin Webberville Monitor*, Figure 3-3: *24-Hour $PM_{2.5}$ Concentrations, Event days and Tier 1 and Tier 2 Thresholds for the Austin North Hills Monitor*, and Figure 3-4: *24-Hour $PM_{2.5}$ Concentrations, Event days and Tier 1 and Tier 2 Thresholds for the National Seashore Monitor,* illustrate the 24-hour $PM_{2.5}$ concentrations on 2022, 2023, and 2024 event days compared to non-event days relative to the Tier levels for each monitor.

[7] https://www.epa.gov/air-quality-analysis/pm25-tiering-tool-exceptional-events-analysis

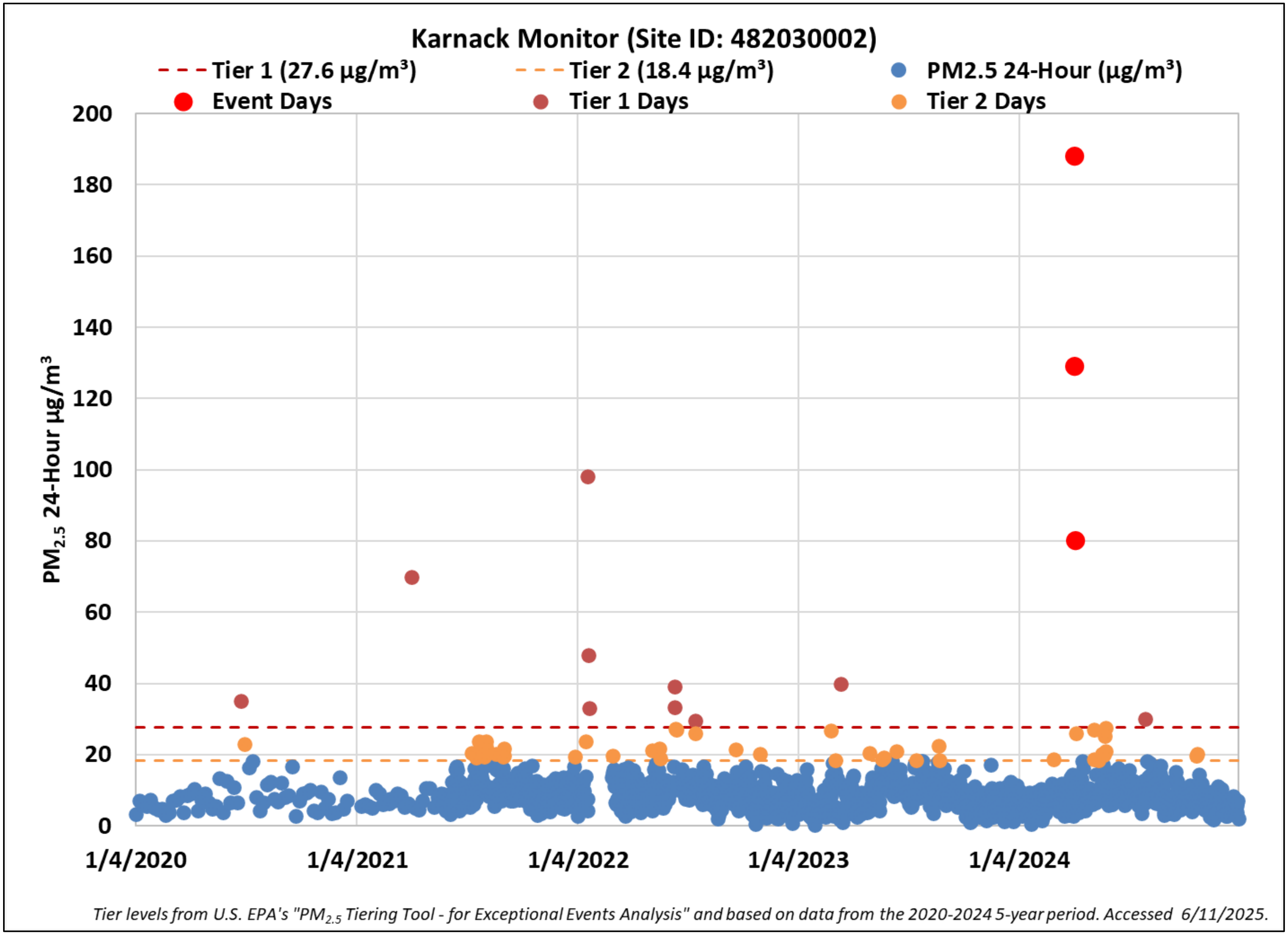


**Figure 3-1: 24-Hour $PM_{2.5}$ Concentrations, Event days and Tier 1 and Tier 2 Thresholds the Karnack Monitor**

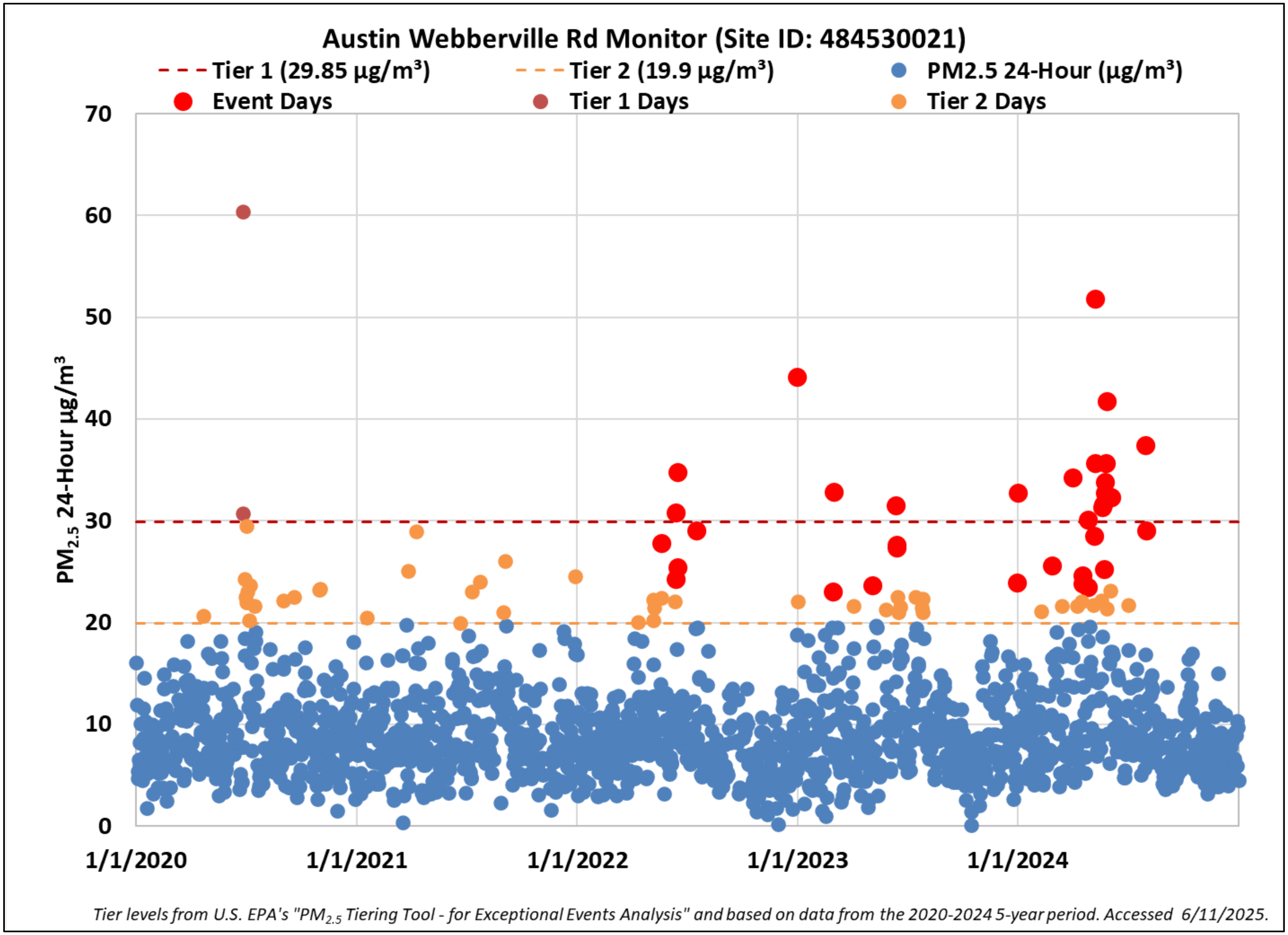


**Figure 3-2: 24-Hour $PM_{2.5}$ Concentrations, Event days and Tier 1 and Tier 2 Thresholds for the Austin Webberville Monitor**

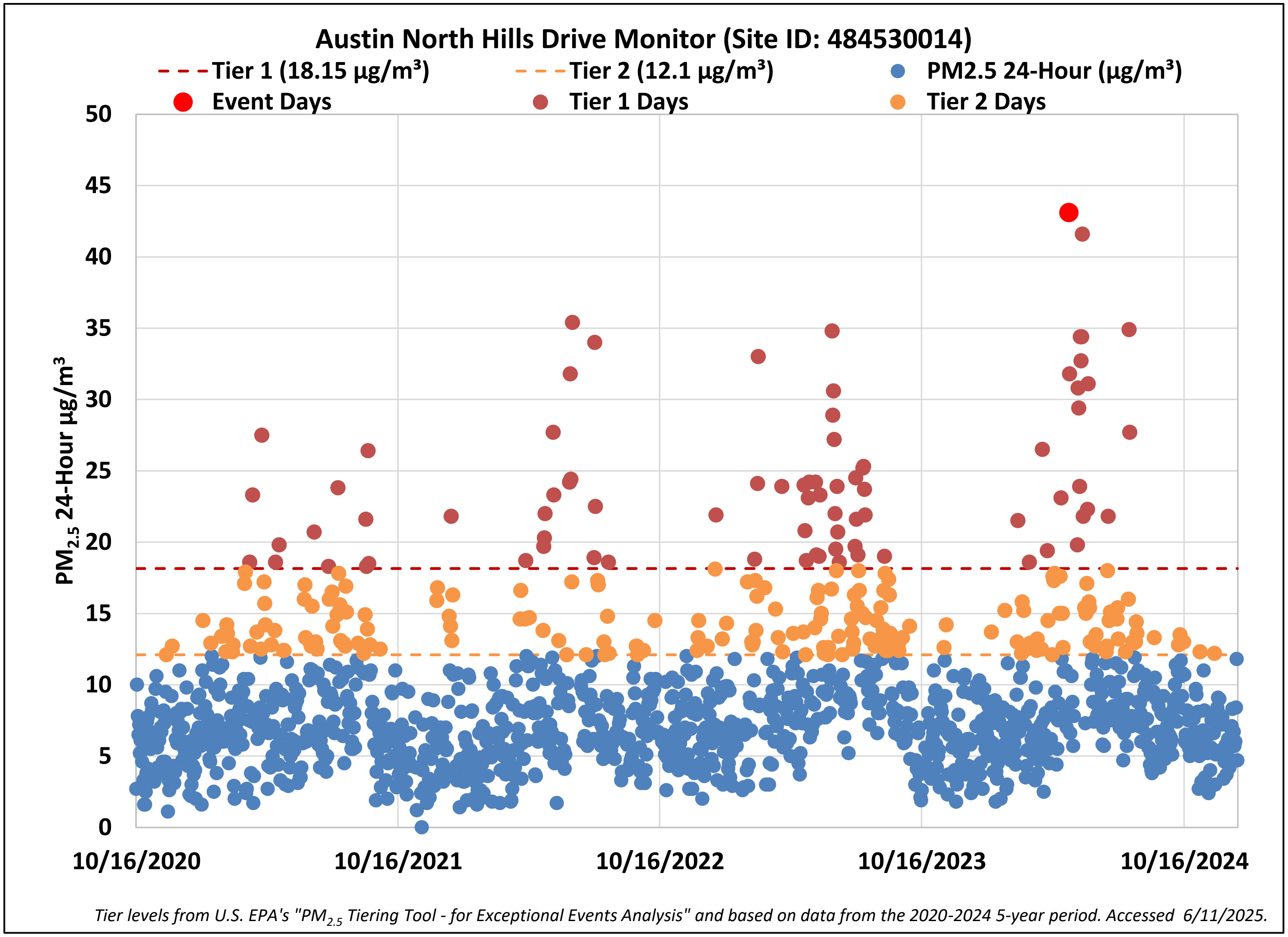


**Figure 3-3: 24-Hour $PM_{2.5}$ Concentrations, Event days and Tier 1 and Tier 2 Thresholds for the Austin North Hills Monitor**

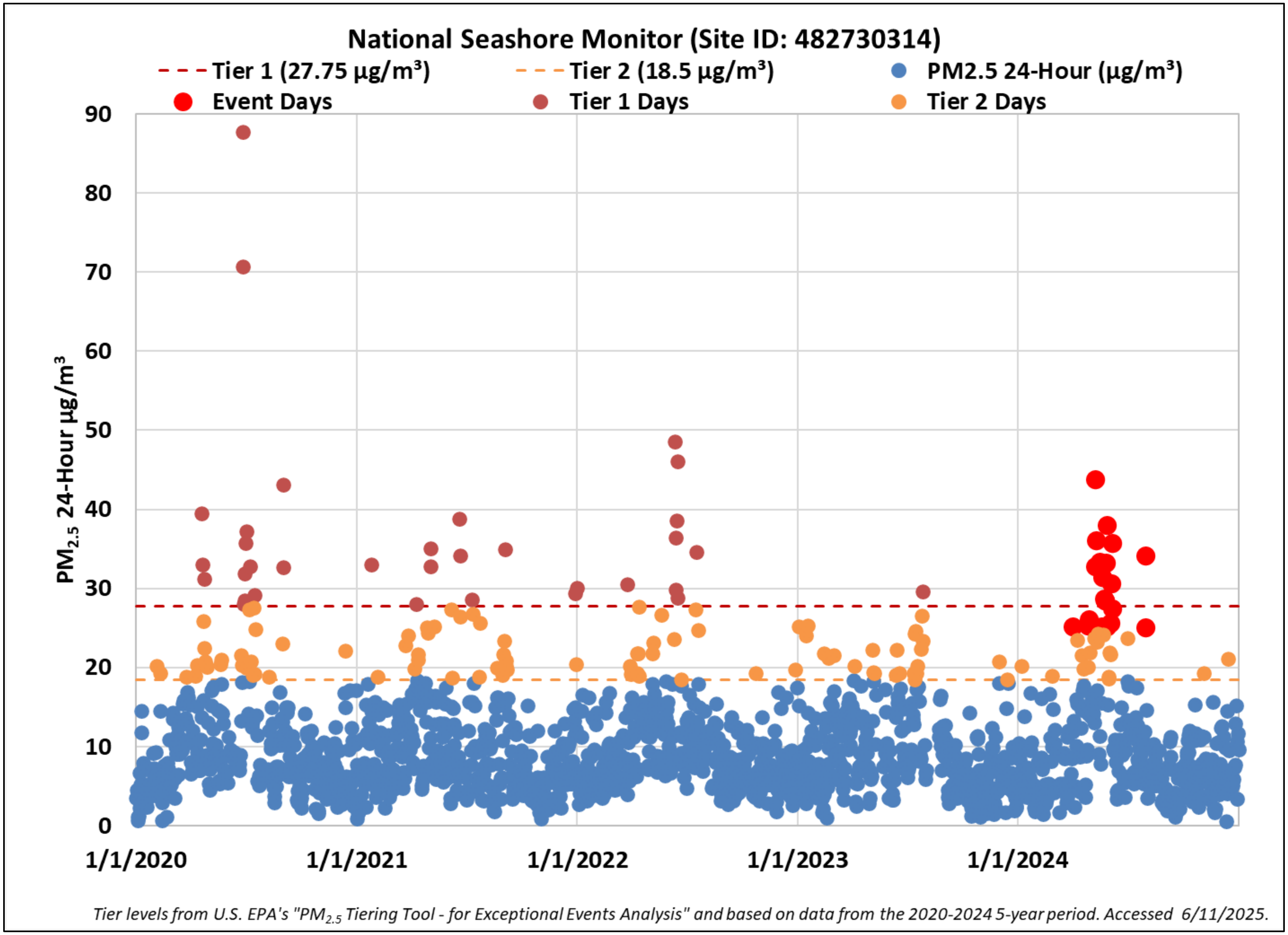


**Figure 3-4: 24-Hour $PM_{2.5}$ Concentrations, Event days and Tier 1 and Tier 2 Thresholds for the National Seashore Monitor**

## 3.2 CLEAR CAUSAL EVIDENCE

In addition to the figures in Section 3.1, there are other types of evidence which are used to show a causal relationship between exceptional events and the influenced $PM_{2.5}$ concentrations. Imagery and data used for the clear causal evidence come from multiple sources:

- Air parcel trajectories were produced using the National Oceanic and Atmospheric Administration (NOAA) Applied Research Laboratory (ARL) HYSPLIT model available on the ARL HYSPLIT webpage: https://www.arl.noaa.gov/hysplit/. HYSPLIT models simulate the dispersion and trajectory of substances transported and dispersed through the atmosphere over local to global scales. The backward trajectory analyses presented in this document were used to determine the origin of air masses and establish source-receptor relationships.
  - For the combined trajectory and fire maps, these trajectories show the modeled path of the air mass from 72 hours arriving at different heights (100 meters, 500 meters, 800 meters above ground level (AGL)) to the monitor and arriving at the hour with the highest concentration on the relevant date. The meteorological data input used for these trajectories comes from the Global Data Assimilation System (GDAS), which is run by the National Weather Service's National Centers for Environmental Prediction (NCEP). Additional information is available at: https://www.ready.noaa.gov/gdas1.php.
  - For the dust trajectories from Africa, forward trajectories started from a matrix that was placed over western Africa. With the matrix utility, the user specifies the southwest point and northeast point of a four-sided polygon as well as the time at which trajectories are to be generated. When the matrix utility is run, trajectories for all points within the polygon are simultaneously initiated. In this application, there were approximately 200 trajectory starting points. The duration of each trajectory was 240 to 360 hours (10 to 15 days) depending on how long it took for the air parcels to reach Texas. The meteorological data input used is also GDAS.
  - For forward trajectories on days impacted by fires in Mexico/Central America, trajectories were started 72 hours ahead of the event day at 500 meters AGL using the GDAS meteorological data.
- Hourly $PM_{2.5}$ event concentrations were compared with typical concentrations (Tier III median) for each hour. A "typical" concentration was defined as the median hourly $PM_{2.5}$ concentration at a particular monitor for all Tier 3 dates that had available data from 2020 through 2024. Tier 1 and Tier 2 dates were not included in this dataset because these two classifications are commonly associated with exceptional events and were therefore not considered as "typical." Tiering classifications were based on 2020 through 2024 data available via the EPA's tiering tool: https://www.epa.gov/air-quality-analysis/pm25-tiering-tool-exceptional-events-analysis. Data are from Texas Air Monitoring System (TAMIS) files sourced from EPA's Air Quality System (AQS) Raw Data Report: https://www.epa.gov/outdoor-air-quality-data. Data were downloaded on October 31, 2024.
- Smoke plume maps are from the AirNow Fire and Smoke Map: https://fire.airnow.gov/.[8] This map also shows the Air Quality Index (AQI) for each monitor. Additional information about AQI is available on the AirNow website: https://www.airnow.gov/aqi/aqi-basics/.
- Media reports and TCEQ forecast discussions are provided in Appendix C. Media report links are referenced with the figure. TCEQ forecasts for event days are archived and available at: https://amdaftp.tceq.texas.gov/exceptional_events/.
- Satellite imagery from NASA Worldview: https://worldview.earthdata.nasa.gov/ was captured using Corrected Reflectance (True Color) layers from the MODIS (Moderate

[8] AirNow is a partnership of the U.S. Environmental Protection Agency, National Oceanic and Atmospheric Administration (NOAA), National Park Service, NASA, Centers for Disease Control, and tribal, state, and local air quality agencies.

Resolution Imaging Spectroradiometer) instrument on either Aqua or Terra satellites. The Terra satellite travel north to south across the equator in the late morning where the Aqua satellite travels south to north across the equator in the early afternoon. The satellites used for each event date were chosen based on the best representation of potential evidence.

### 3.2.1 Group 1 – Evidence for June 14, 2022, African Dust $PM_{2.5}$ Event for the Webberville Monitor

June 14, 2022, was identified as a Tier 2 day at the Webberville Monitor due to African dust. The daily $PM_{2.5}$ concentration was 24.2 μg/m³. Figure 3-5: *Hourly $PM_{2.5}$ Concentrations on June 14, 2022, Compared to Typical Concentrations at the Webberville Monitor* shows the peak concentration of $PM_{2.5}$ 2:00 p.m. CDT.

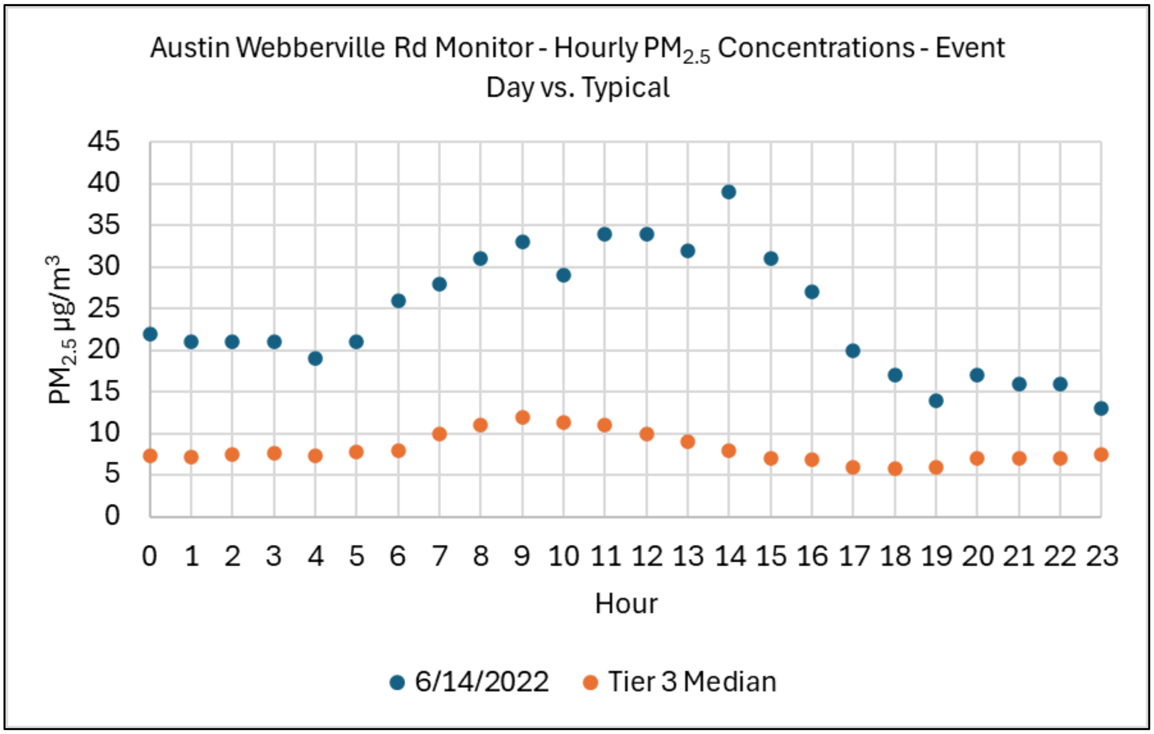


**Figure 3-5: Hourly $PM_{2.5}$ Concentrations on June 14, 2022, Compared to Typical Concentrations at the Webberville Monitor**

The TCEQ forecast (Table C-1) discusses the potential for elevated $PM_{2.5}$ concentrations in Central and South Texas due to African dust. Backward trajectories from this monitor (*Figure 3-6: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville Monitor on June 14, 2022*) indicate transport from the Gulf of America and curving out to the Atlantic Ocean. Figure 3-9: *NOAA HYSPLIT 72-Hour Forward Trajectories Originating from the Saharan Desert, Starting May 31, 2022*, shows the transport of dust from northern Africa to Texas. Figure 3-7: *AirNow Tech Aerosol Optical Depth (AOD) Map, with MODIS Terra and Aqua Satellite Layers on June 14, 2022*, and Figure 3-8: *Terra/MODIS Corrected Reflectance (True Color) Satellite Imagery from June 14, 2022, Showing Haze in the Gulf of America and Central Texas* shows satellite imagery verifying the transport of African dust into Texas on June 14, 2022.

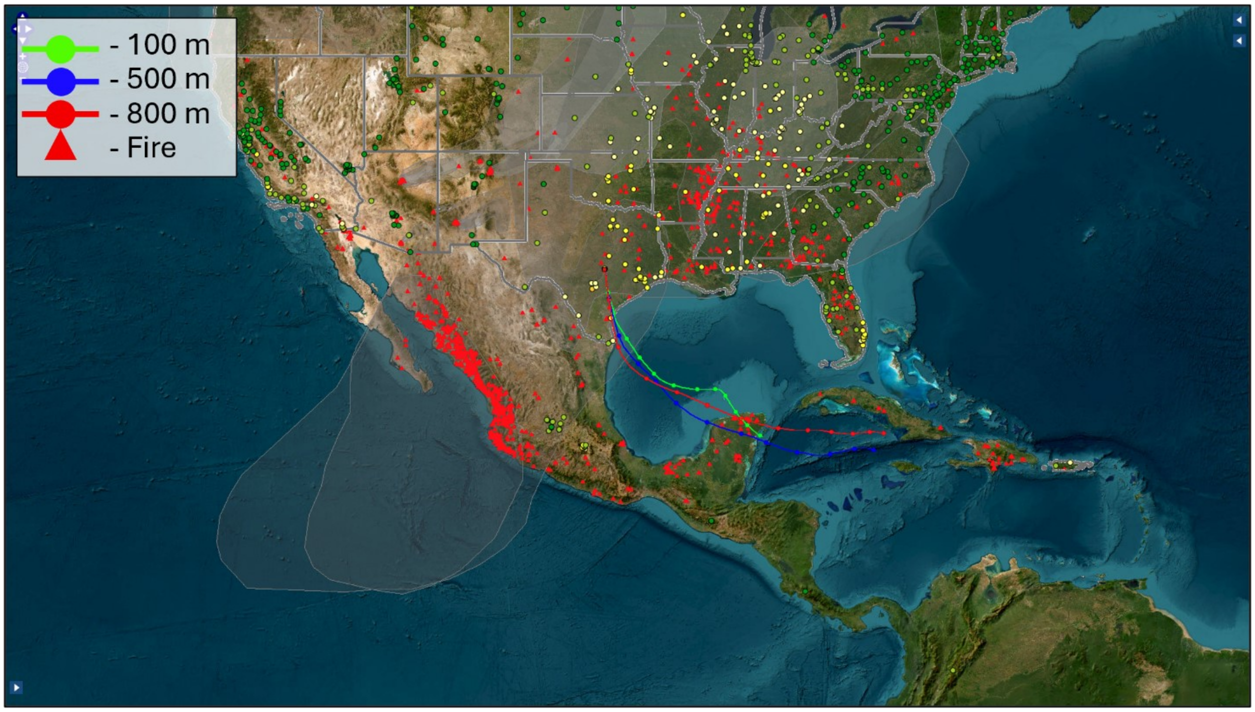


**Figure 3-6: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville Monitor on June 14, 2022**

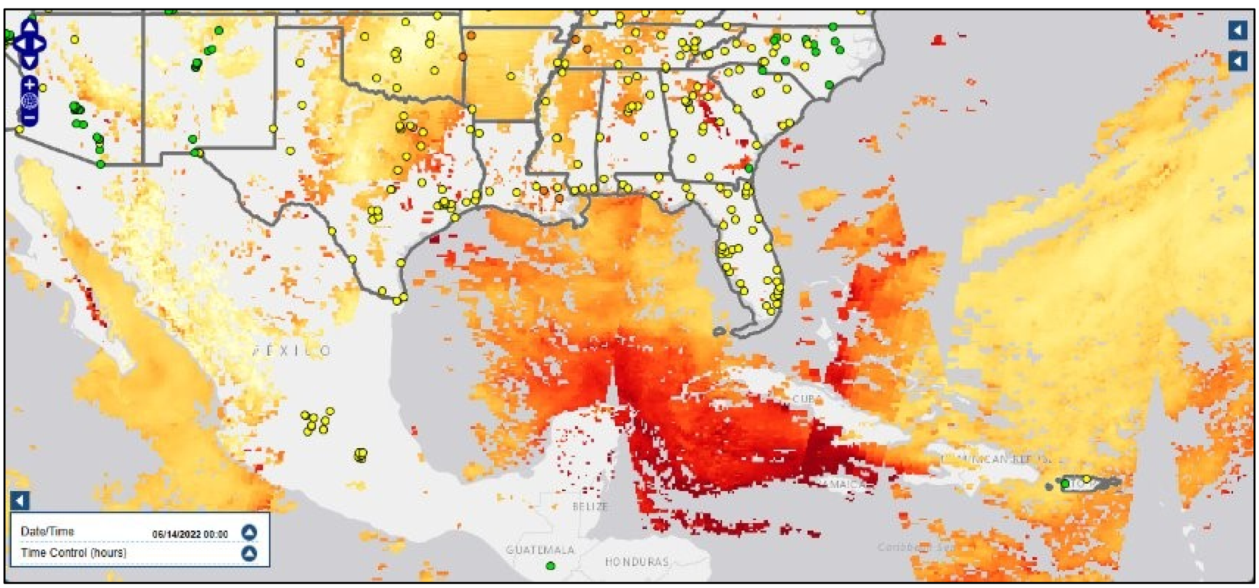


**Figure 3-7: AirNow Tech Aerosol Optical Depth (AOD) Map, with MODIS Terra and Aqua Satellite Layers on June 14, 2022**

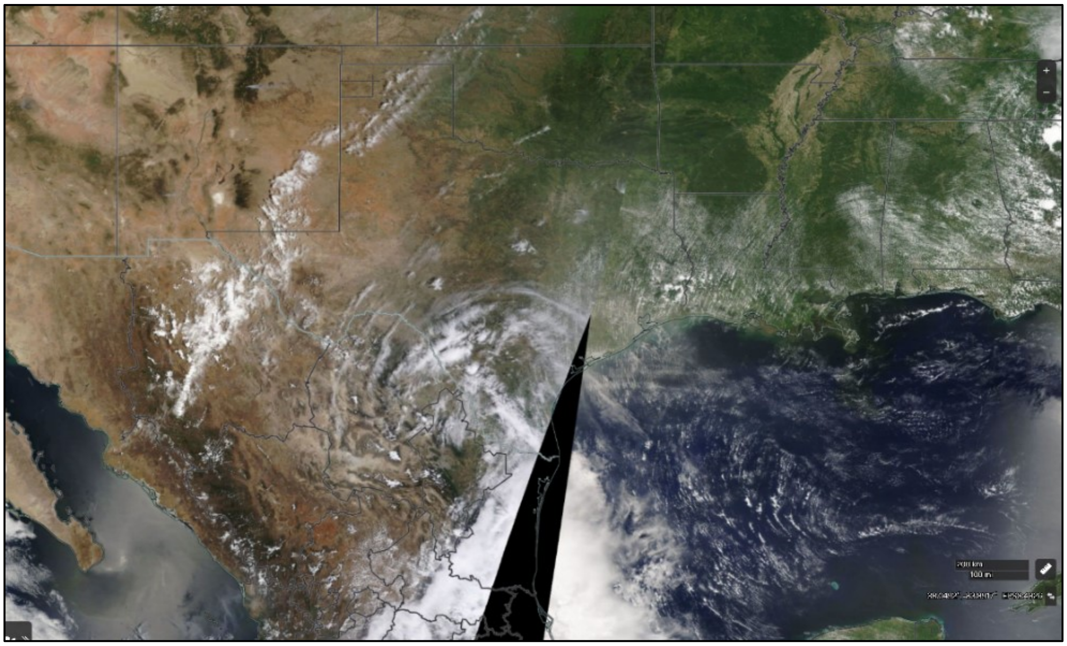

**Figure 3-8: Terra/MODIS Corrected Reflectance (True Color) Satellite Imagery from June 14, 2022, Showing Haze in the Gulf of America and Central Texas**

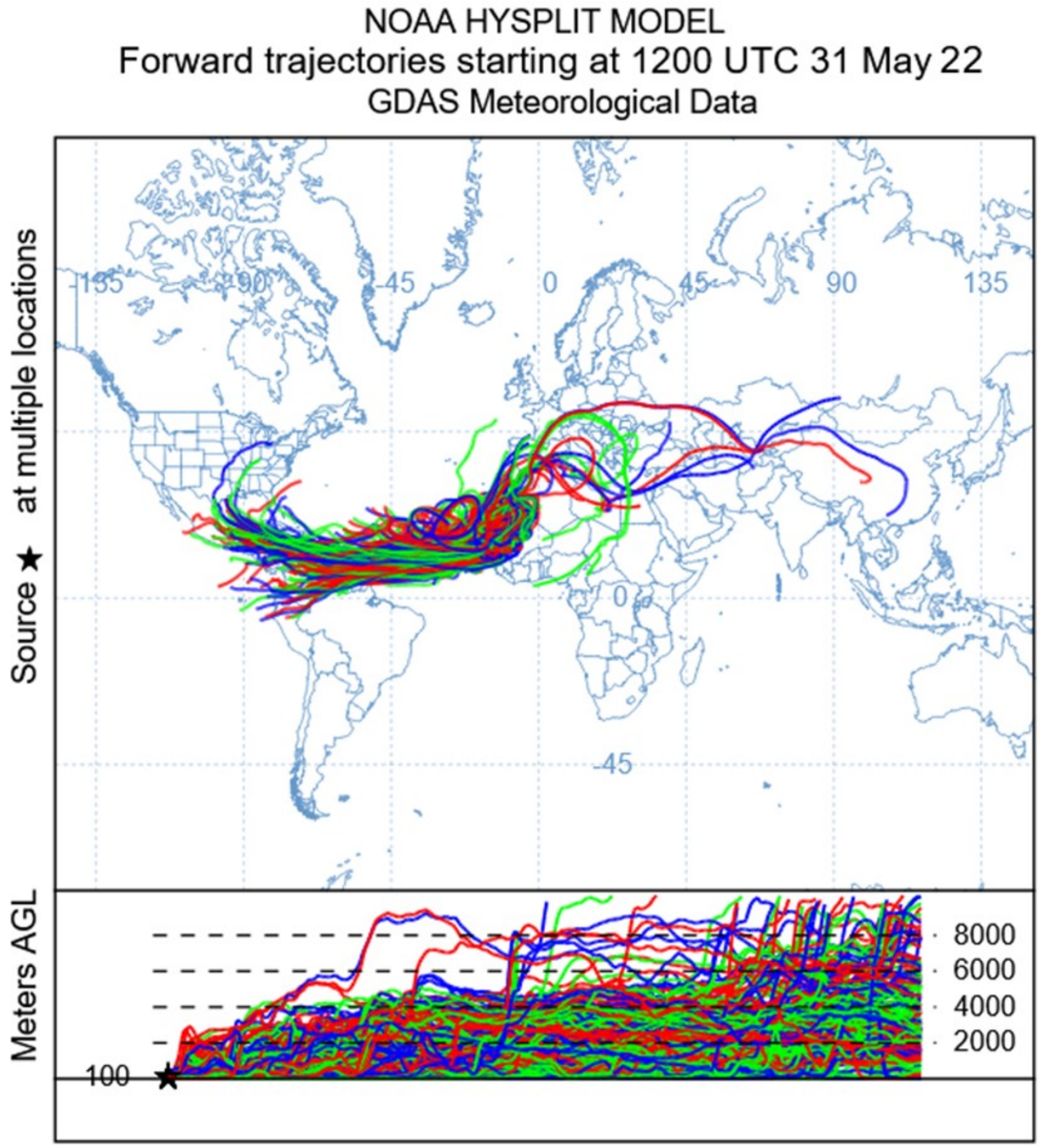


**Figure 3-9: NOAA HYSPLIT 72-Hour Forward Trajectories Originating from the Saharan Desert, Starting May 31, 2022**

### 3.2.2 Group 2 – Evidence for March 1, 2023, Fire (Mexico/Central America) $PM_{2.5}$ Event for the Webberville Monitor

March 1, 2023, was identified as a Tier 2 day at the Webberville monitor. The daily $PM_{2.5}$ concentration was 24.6 µg/m$^3$, with elevated concentrations of $PM_{2.5}$ sustaining through the day, as seen on the hourly concentration graph (Figure 3-10: *Hourly $PM_{2.5}$ Concentrations on March 1, 2023, Compared to Typical Concentrations at the Webberville Monitor*). The TCEQ forecast (Table C-2) describes elevated background concentrations of particulate matter due to smoke from seasonal fire activity in eastern Mexico. Backward trajectories (Figure 3-11: *AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville Monitor on March 1, 2023*), the smoke plume seen in Figure 3-12: *AirNow HMS Smoke Plume March 1, 2023*, and the haze in the Gulf of America seen in Figure 3-13: *Terra/MODIS Corrected Reflectance (True Color) Satellite Imagery from March 1, 2023, Showing Haze in the Yucatan and Gulf of America* support this forecast, showing transport of smoke to the Webberville monitor.

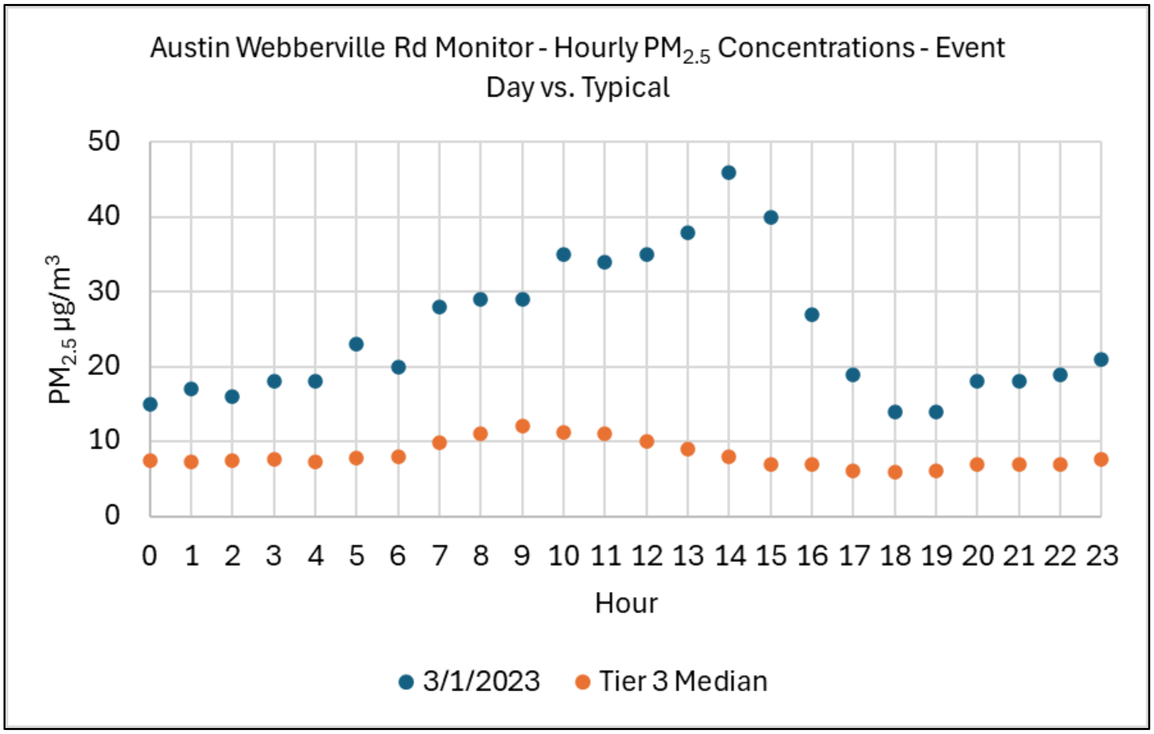


**Figure 3-10: Hourly $PM_{2.5}$ Concentrations on March 1, 2023, Compared to Typical Concentrations at the Webberville Monitor**

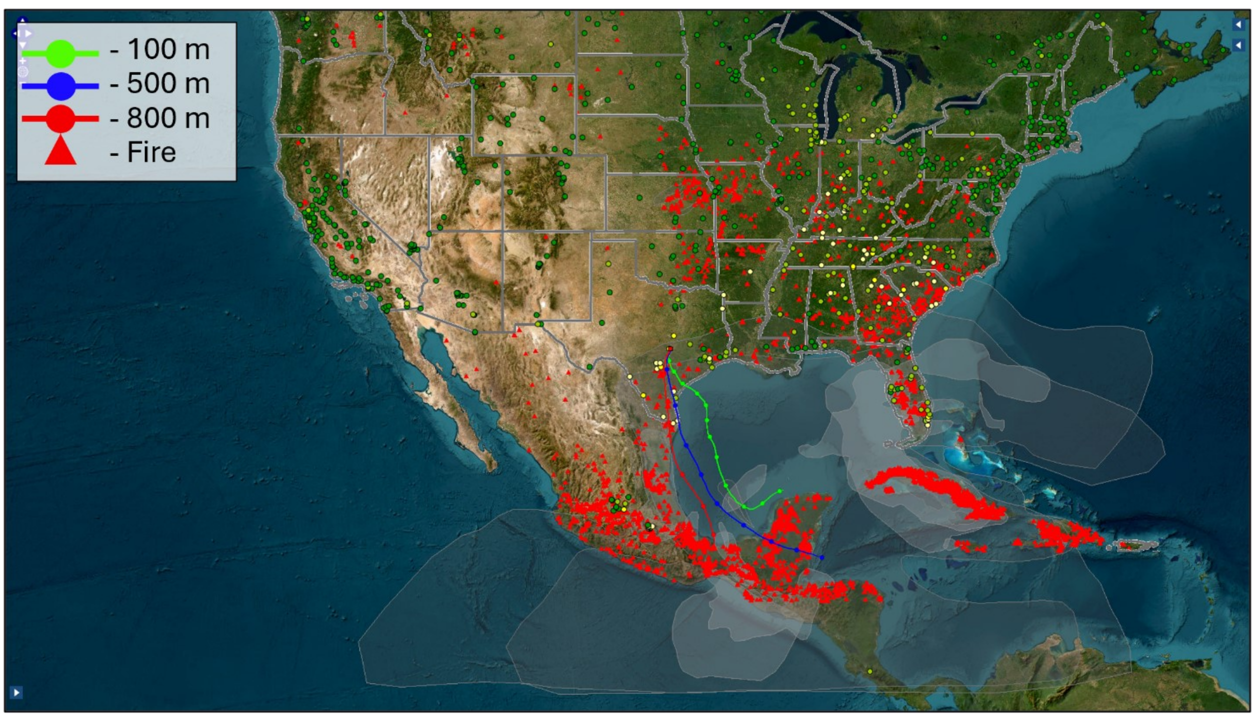


**Figure 3-11: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville Monitor on March 1, 2023**

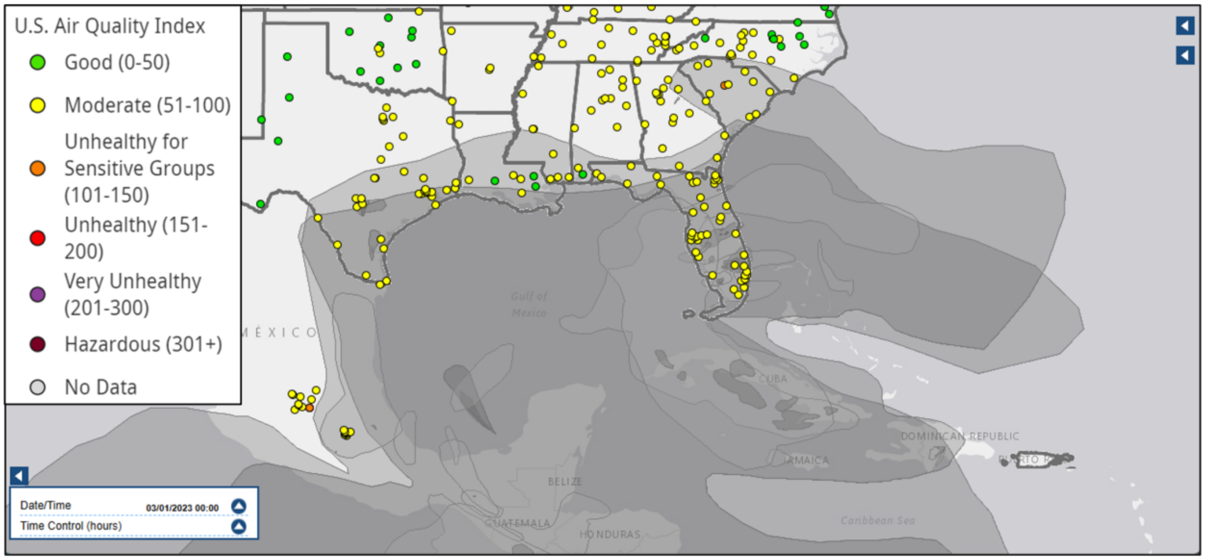


**Figure 3-12: AirNow HMS Smoke Plume March 1, 2023**

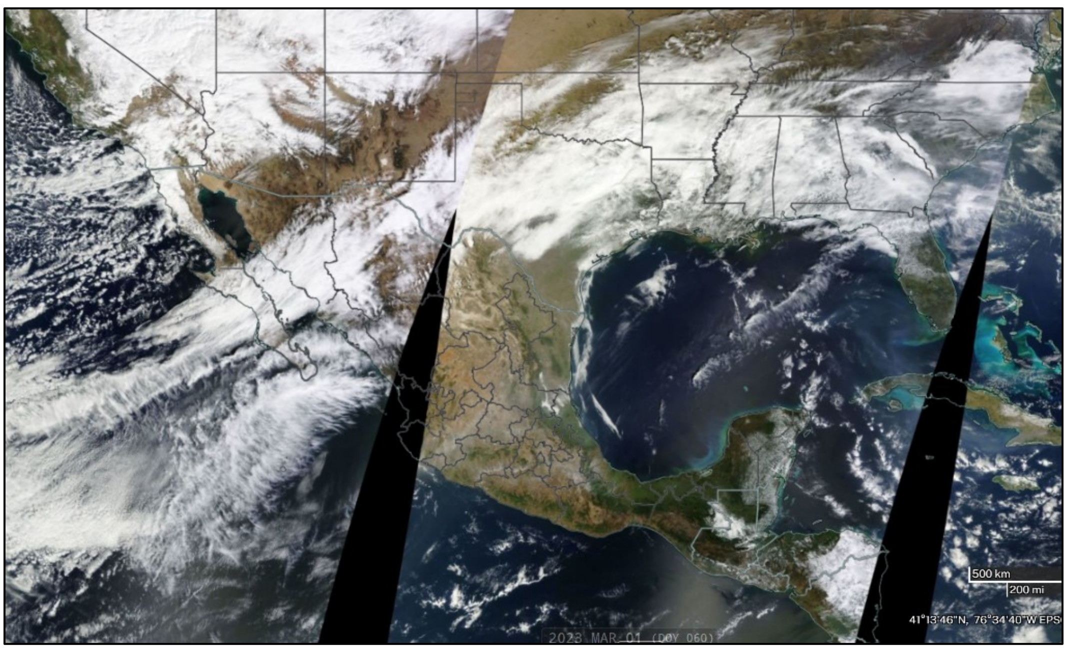


**Figure 3-13: Terra/MODIS Corrected Reflectance (True Color) Satellite Imagery from March 1, 2023, Showing Haze in the Yucatan and Gulf of America**

### 3.2.3 Group 3 – Evidence for May 5, 2023, Fire (Mexico/Central America) $PM_{2.5}$ Event for the Webberville Monitor

May 5, 2023, is classified as a Tier 2 day with daily $PM_{2.5}$ concentrations of 23.6 µg/m³ at the Webberville monitor. The elevated concentrations were due to smoke from fires in Mexico, and hourly $PM_{2.5}$ graphs show the elevated concentrations on both days (Figure 3-14: *Hourly $PM_{2.5}$ Concentrations on May 05, 2023, Compared to Typical Concentrations at the Webberville Monitor*).

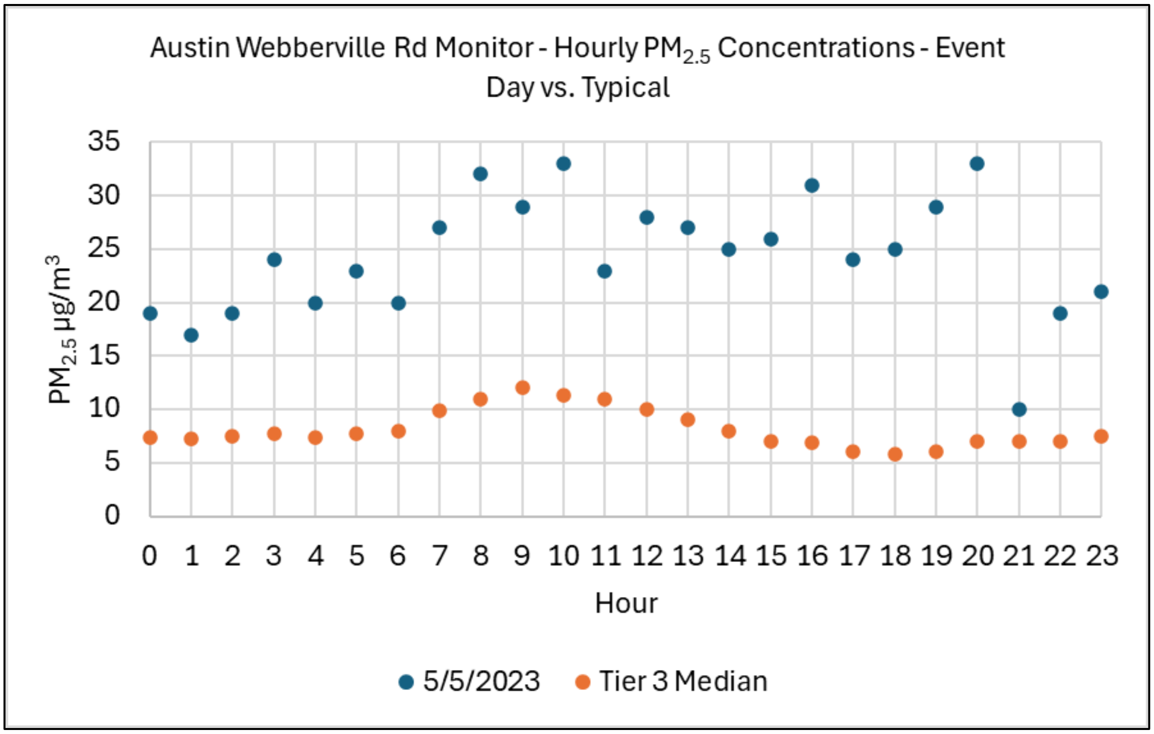


**Figure 3-14: Hourly $PM_{2.5}$ Concentrations on May 05, 2023, Compared to Typical Concentrations at the Webberville Monitor**

TCEQ forecasted smoke from Mexican wildfires over much of Texas on May 5, 2023 (Table C-3). The presence of light and intermediate smoke in Texas was also seen in the NOAA Hazard Management System Fire and Smoke map for May 5, 2023 (Figure A-13). Likewise, Figure 315: *AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville Monitor on May 5, 2023*, shows HYSPLIT backward trajectories moving through light and intermediate smoke plumes towards Texas and back towards fire locations in Mexico. HYSPLIT forward trajectories are shown at low levels flowing from fire locations in Mexico to Central Texas in Figure 317: *NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting on May 2, 2023*. Figure 316: *Terra/MODIS Corrected Reflectance (True Color) Satellite Imagery from May 5, 2023, Showing Transport of Smoke into the Gulf of America* shows the presence of smoke over the Gulf of America and into Texas.

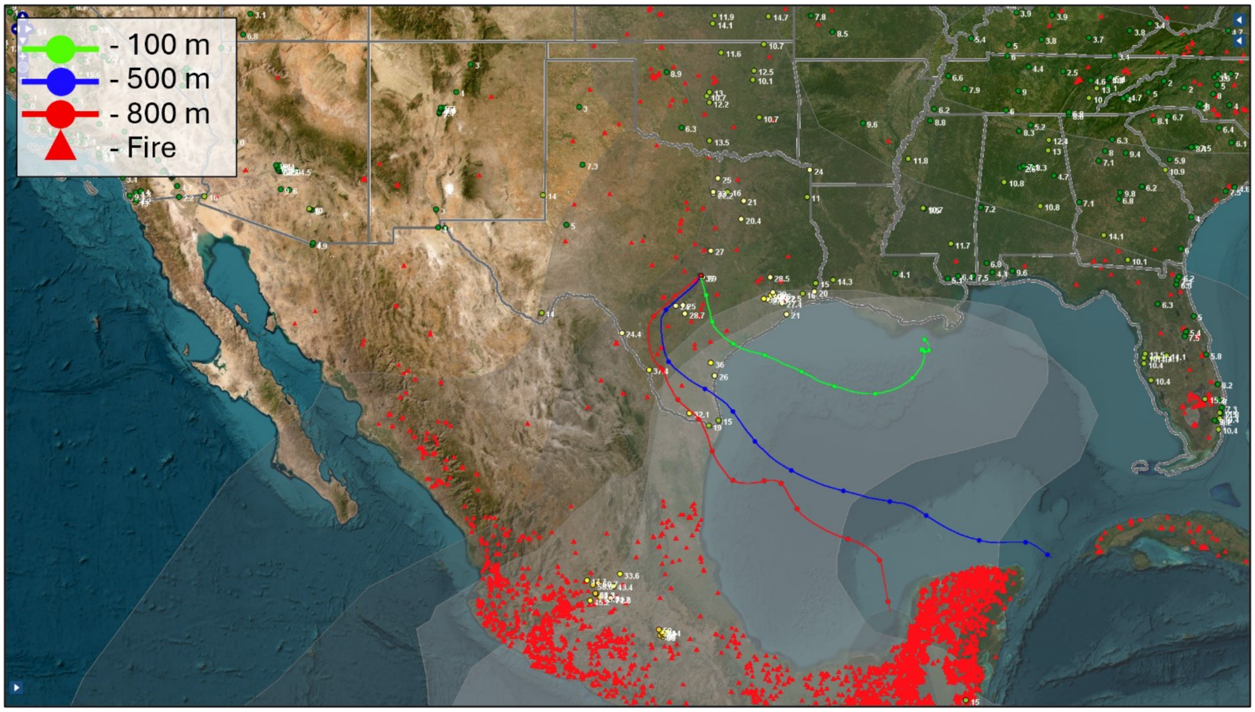


**Figure 3-15: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville Monitor on May 5, 2023**

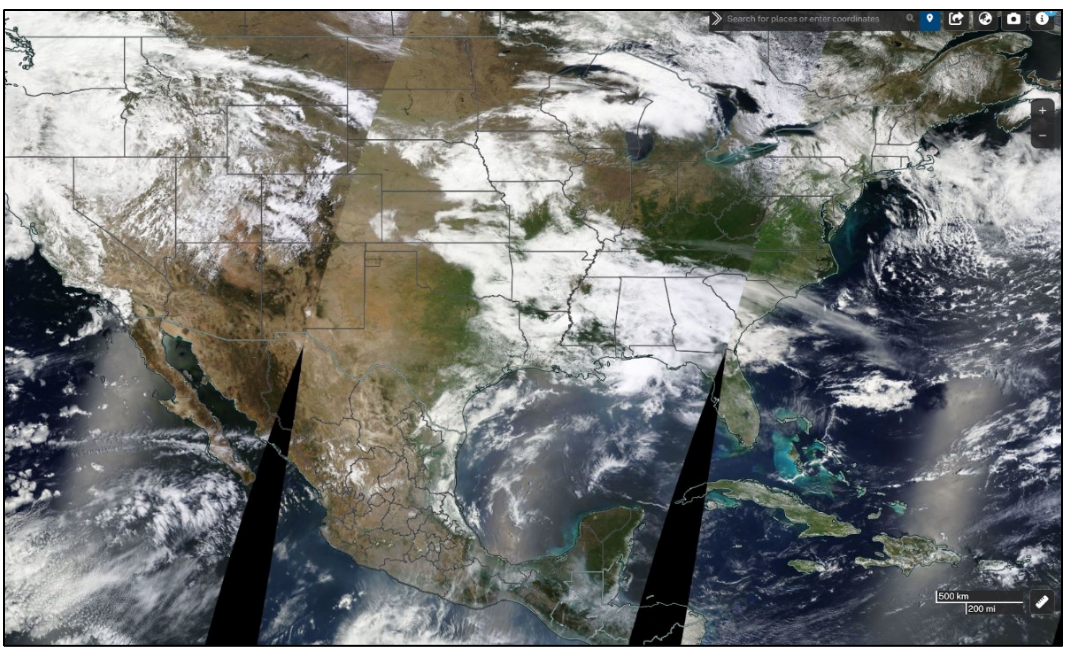

**Figure 3-16: Terra/MODIS Corrected Reflectance (True Color) Satellite Imagery from May 5, 2023, Showing Transport of Smoke into the Gulf of America**

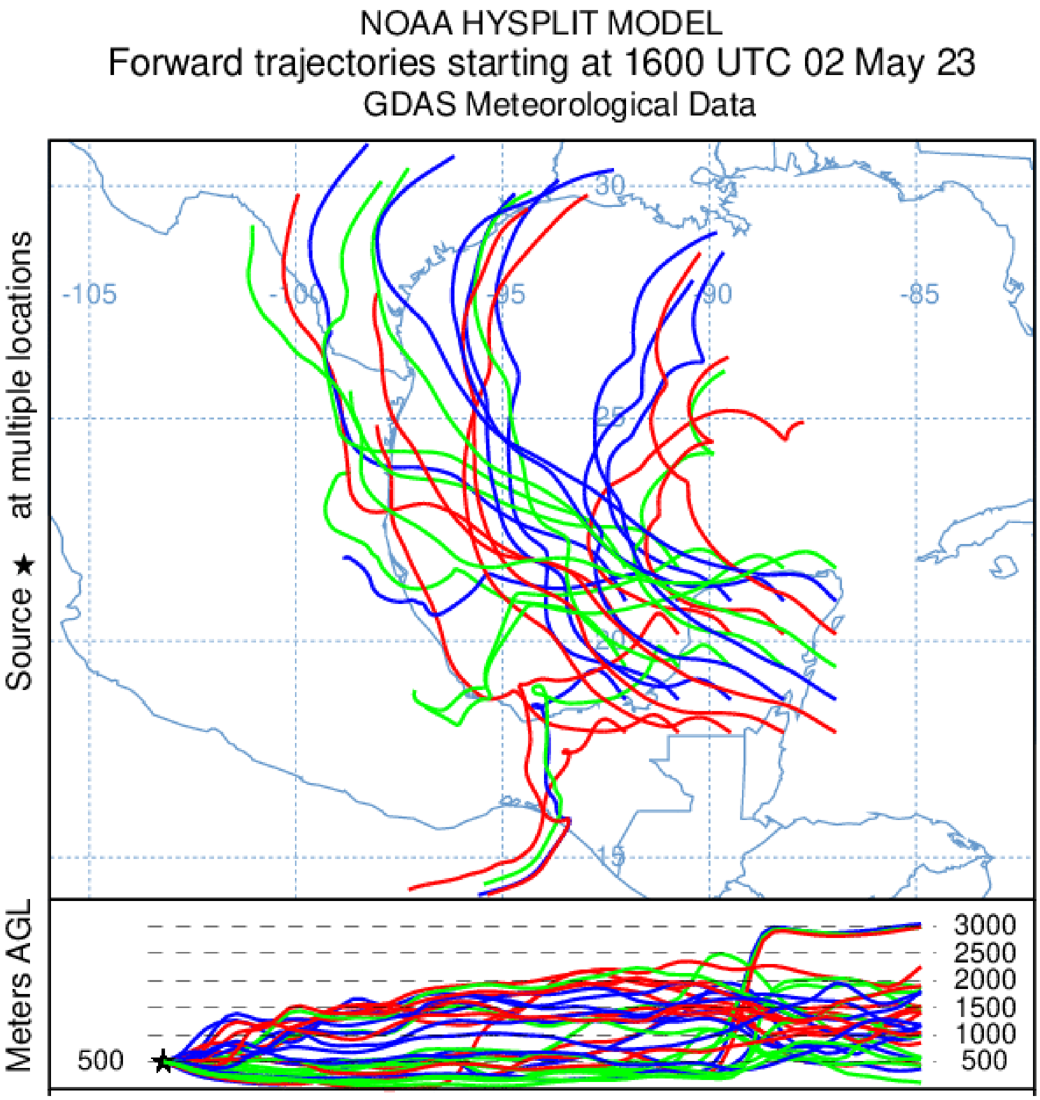


**Figure 3-17: NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting on May 2, 2023**

### 3.2.4 Group 4 – Evidence for December 31, 2023, and January 1, 2024, Fireworks $PM_{2.5}$ Event for the Webberville Monitor

December 31, 2023, and January 1, 2024, were identified as a Tier 2 day and a Tier 1 day, respectively, with daily average $PM_{2.5}$ concentrations of 23.9 μg/m$^3$ and 32.7 μg/m$^3$ at the Webberville monitor. The elevated concentration was linked to New Year's Eve fireworks celebrations. A media report (Figure C-1) states that approximately 20,000 people were expected to attend the fireworks event at Auditorium Shores, within a few miles of the Webberville monitor. Figure 3-18: *Hourly $PM_{2.5}$ Concentrations on December 31, 2023, Compared to Typical Concentrations at the Webberville Monitor* and Figure 3-19: *Hourly $PM_{2.5}$ Concentrations on January 1, 2024, Compared to Typical Concentrations at the Webberville Monitor* show the unusual nighttime $PM_{2.5}$ concentrations peaking at midnight, as one would expect for New Year's Eve. Similarly, Figure 2-6 shows the hourly $PM_{2.5}$ measurements reach a large peak close to midnight.

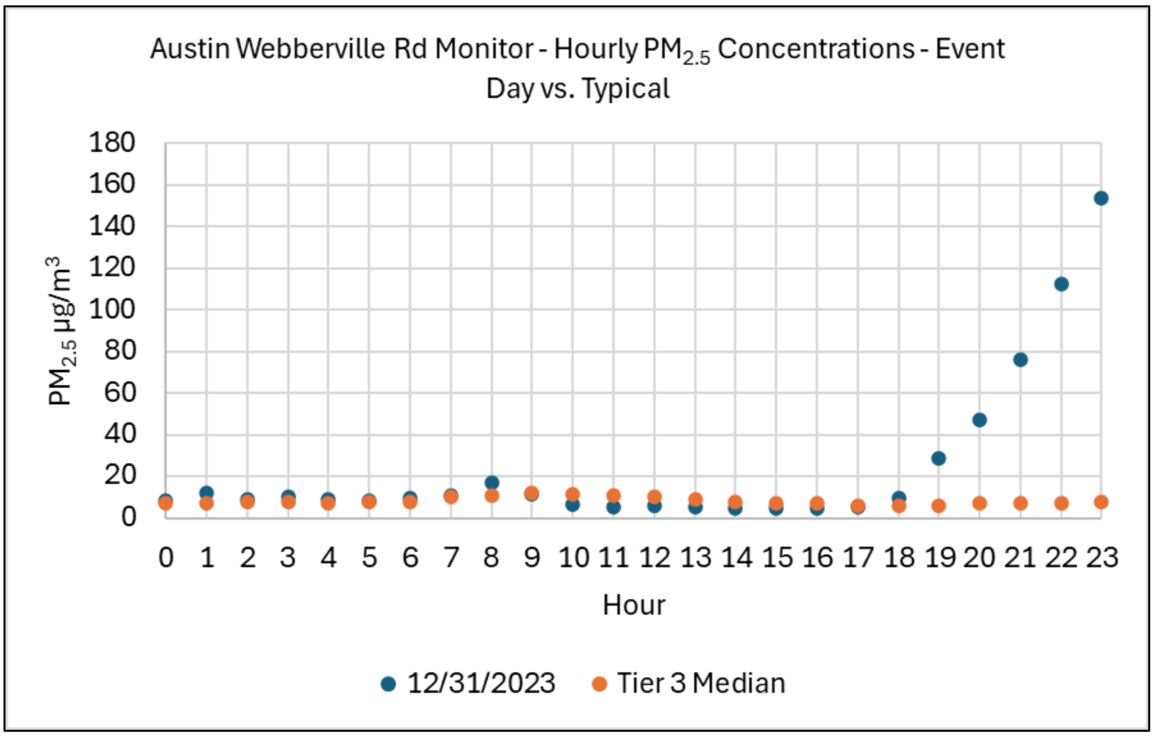


**Figure 3-18: Hourly $PM_{2.5}$ Concentrations on December 31, 2023, Compared to Typical Concentrations at the Webberville Monitor**

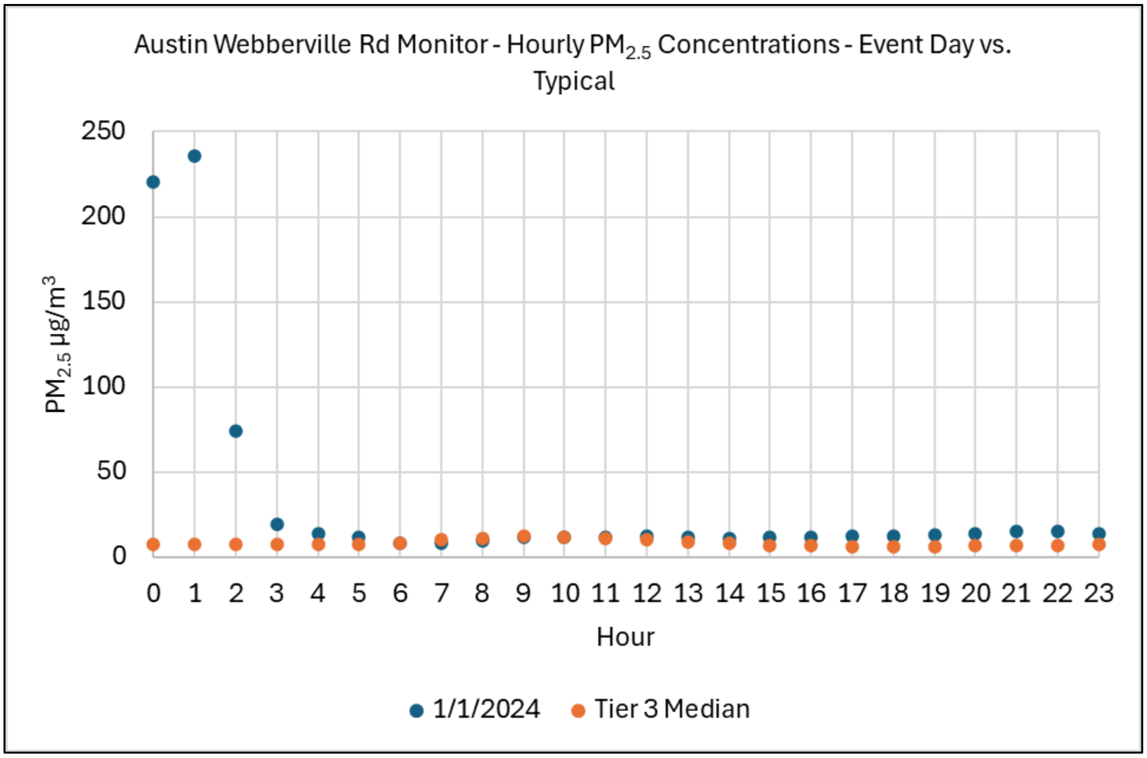


**Figure 3-19: Hourly $PM_{2.5}$ Concentrations on January 1, 2024, Compared to Typical Concentrations at the Webberville Monitor**

### 3.2.5 Group 5 – Evidence for February 27, 2024, Fire (Mexico/Central America) $PM_{2.5}$ Event for the Webberville Monitor

February 27, 2024, was identified as a Tier 2 day at the Webberville monitor due to wildfires in Mexico. The 24-hour concentration at this monitor was 25.6 $\mu g/m^3$, and the elevated concentrations on this event day can be seen compared to concentrations on a non-event day (Figure 3-20: *Hourly $PM_{2.5}$ Concentrations on February 27, 2024, Compared to Typical Concentrations at the Webberville Monitor*). The NOAA HMS Fire and Smoke Map for February 27, 2024 (Figure A-21), shows the locations of fires in west and south Mexico. The meteorological discussion in Section 2.5.5 documents winds coming from the south and west into the Webberville monitor. Backwards and forwards HYSPLIT trajectories (Figure 3-21: *AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville Monitor on February 27, 2024*, and Figure 3-22: *NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting on February 25, 2024*) show the transport from both fire locations to the Webberville monitor.

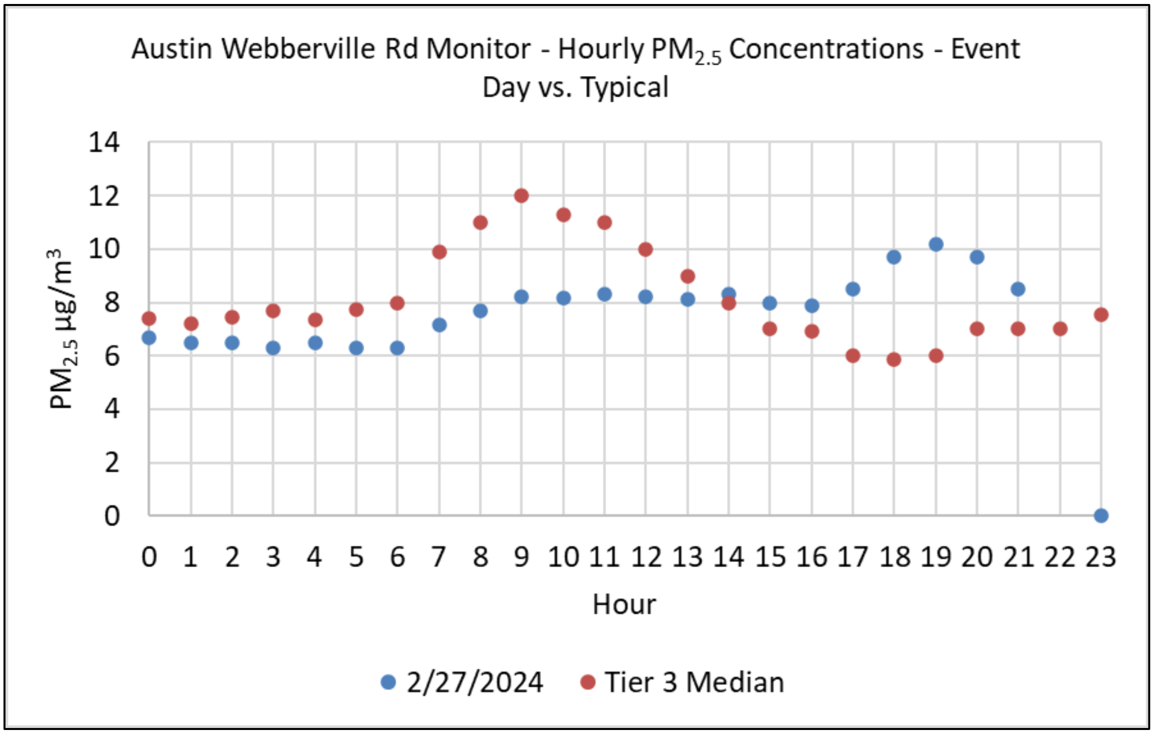


**Figure 3-20: Hourly $PM_{2.5}$ Concentrations on February 27, 2024, Compared to Typical Concentrations at the Webberville Monitor**

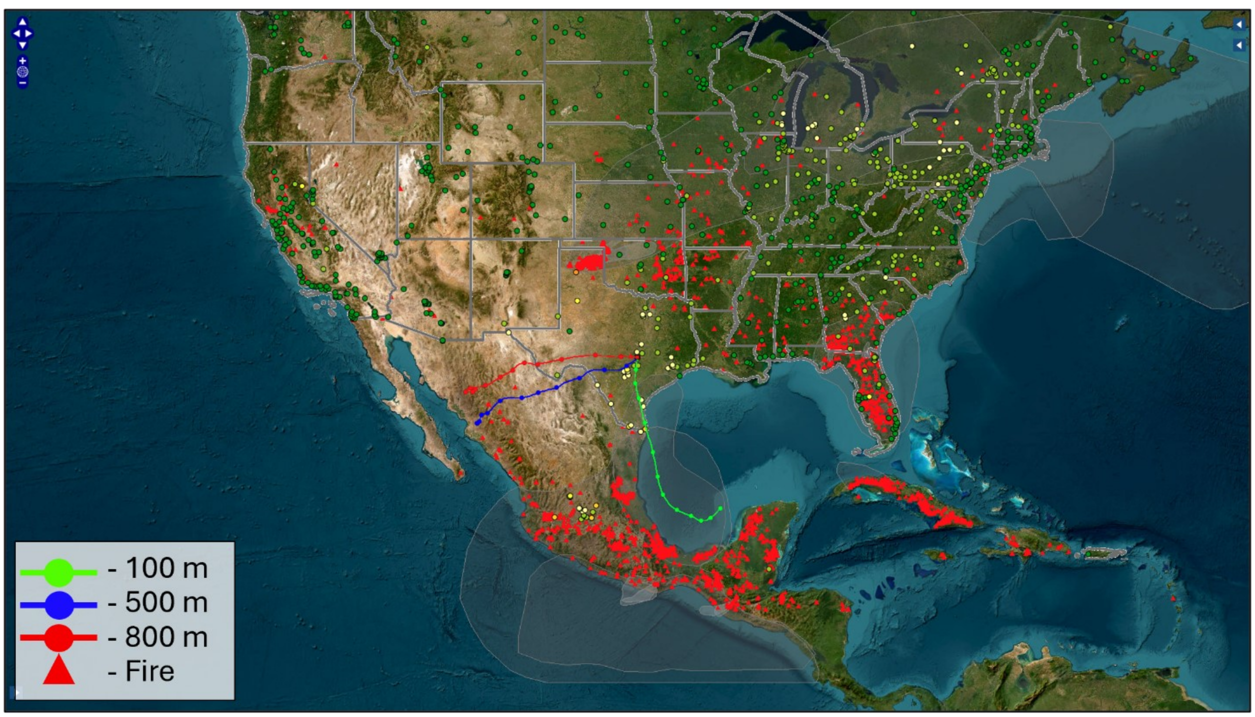


**Figure 3-21: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville Monitor on February 27, 2024**

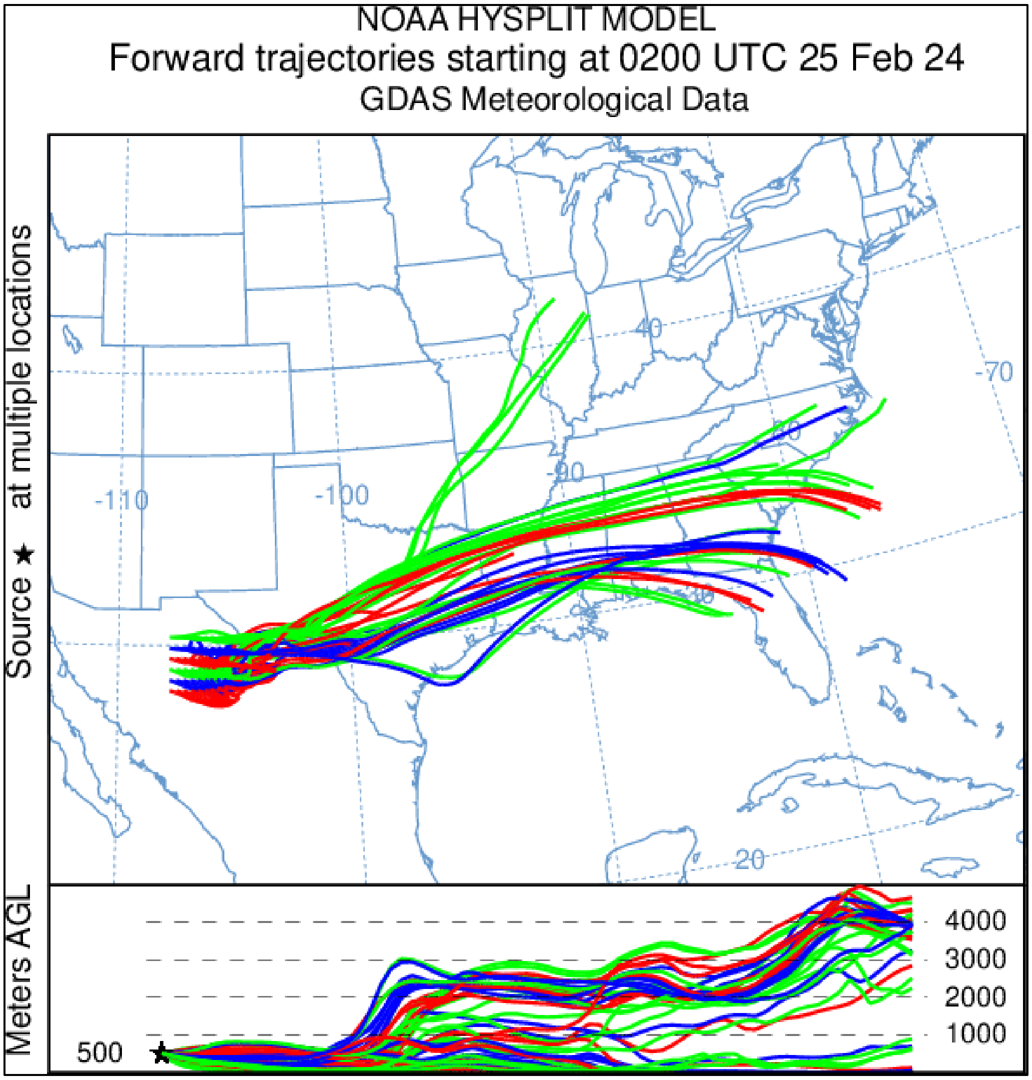


**Figure 3-22: NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting on February 25, 2024**

### 3.2.6 Group 6 – Evidence for April 1, 2024, Fire (Mexico/Central America) Events at Webberville and National Seashore Monitors

April 1, 2024, was identified as a Tier 1 day at the Webberville monitor and a Tier 2 day at the National Seashore monitor due to smoke associated with fires in Mexico and Central America. The daily average concentration of $PM_{2.5}$ was 34.2 µg/m$^3$ at Webberville and 25.2 µg/m$^3$ at the National Seashore monitor. Figure 3-23: *Hourly $PM_{2.5}$ Concentrations on April 1, 2024, Compared to Typical Concentrations at the Webberville monitor* and Figure 3-24: *Hourly $PM_{2.5}$ Concentrations on April 1, 2024, Compared to Typical Concentrations at the National Seashore Monitor* compare measurements on April 1, 2024, to typical days at both monitors and show that concentrations were higher on all hours of the day on the event day at both monitors.

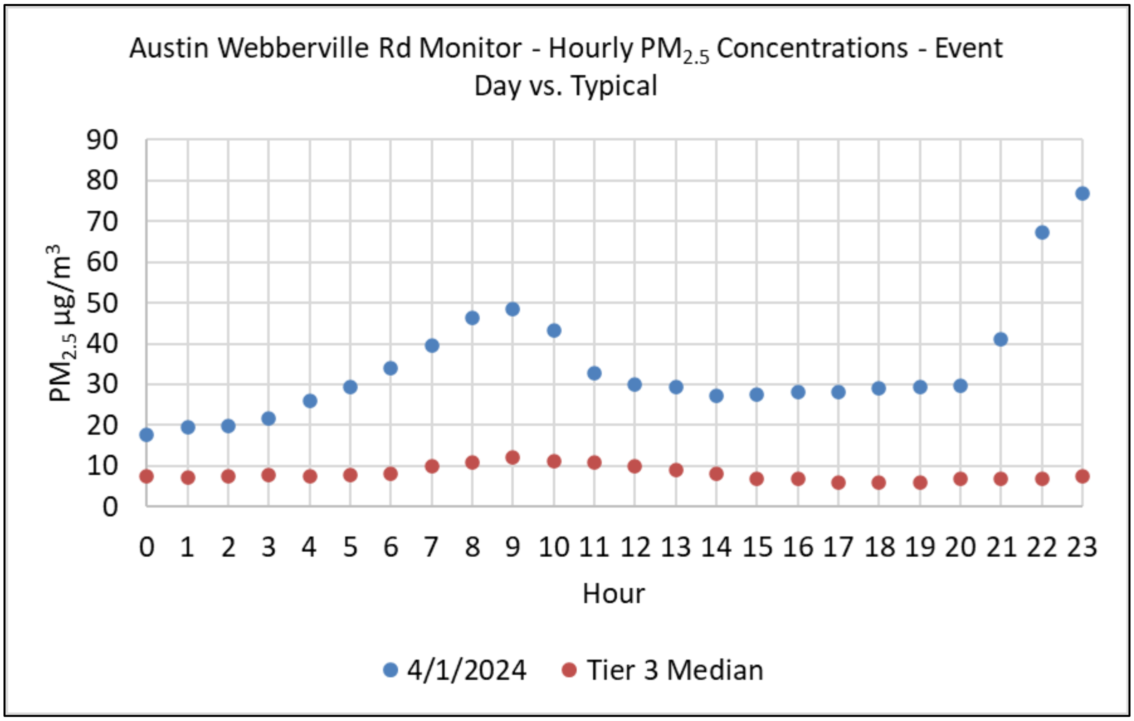


**Figure 3-23: Hourly $PM_{2.5}$ Concentrations on April 1, 2024, Compared to Typical Concentrations at the Webberville monitor**

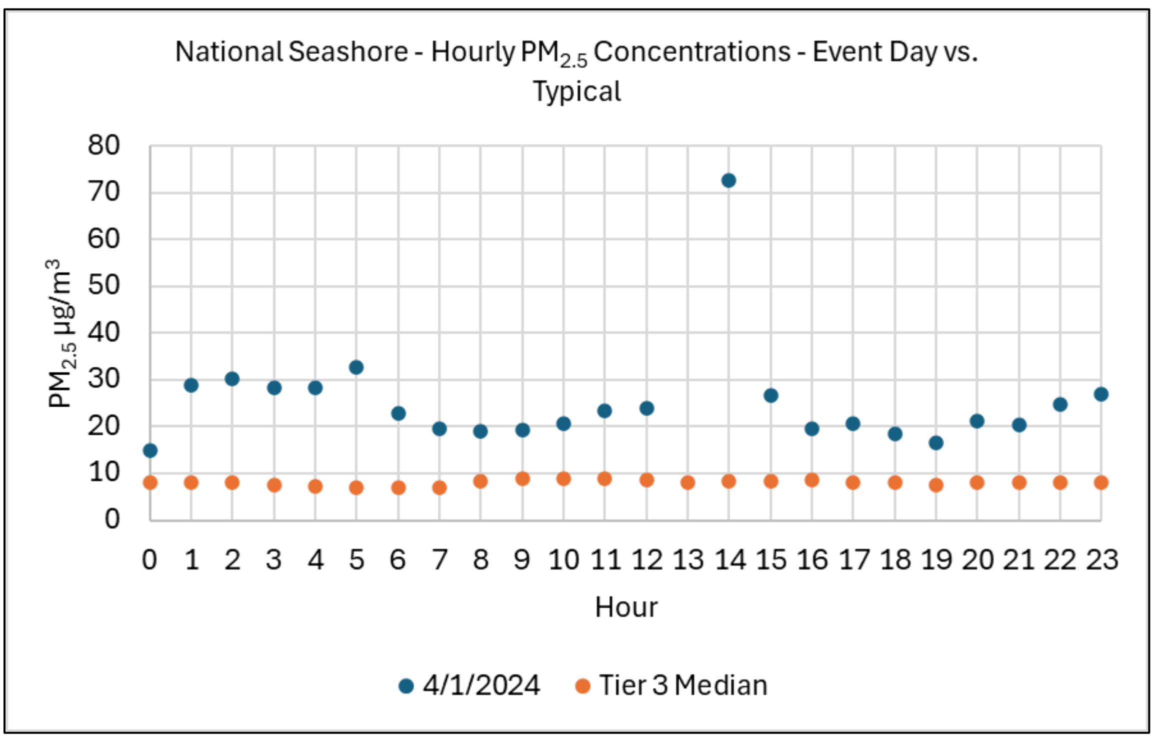


**Figure 3-24: Hourly $PM_{2.5}$ Concentrations on April 1, 2024, Compared to Typical Concentrations at the National Seashore Monitor**

The TCEQ forecast (Table C-5) discussed moderate to heavy smoke affecting the eastern two thirds of Texas. Figure 3-25: *AIRNow HMS Smoke Plume for April 1, 2024*, clearly shows the presence of light and moderate smoke clouds from the Yucatan area, up the east coast of Mexico, and on to the Texas coast. Furthermore, Figure 3-26: *AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville Monitor on April 1, 2024*, and Figure 3-27: *AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on April 1, 2024*, show HYSPLIT backward trajectories from AIRNow tracing a path back to fire locations on the Yucatan Peninsula and southern Mexico. Forward trajectories in *Figure 3-28: NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting on March 29, 2024*, show a strong transport from the Yucatan Peninsula straight along the east coast of Mexico over the National Seashore and Webberville monitors.

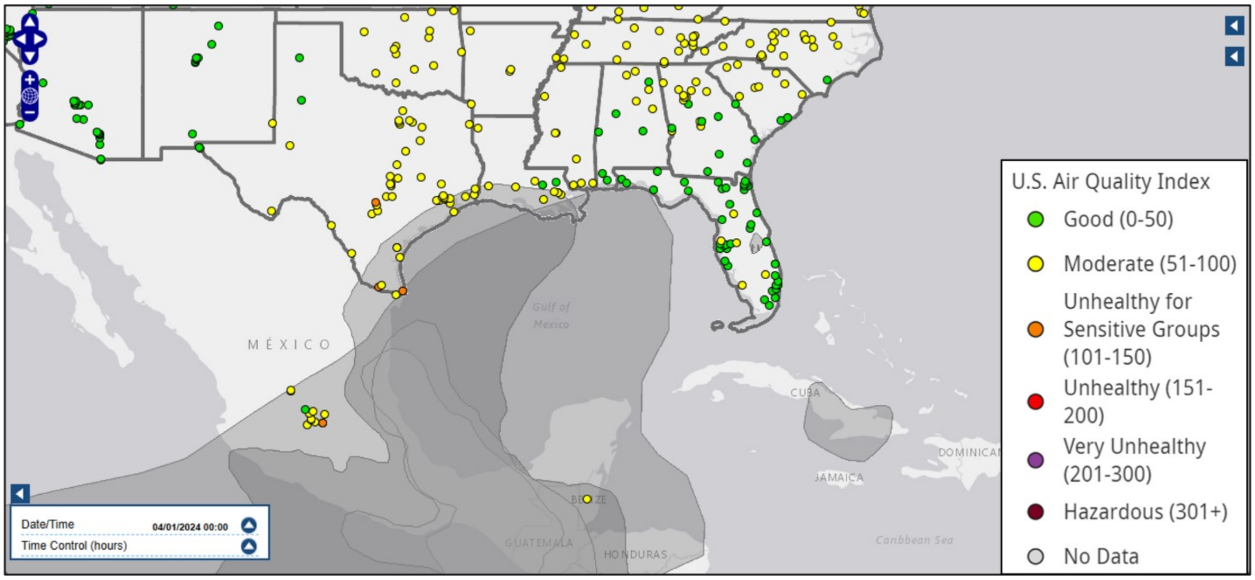


**Figure 3-25: AIRNow HMS Smoke Plume for April 1, 2024**

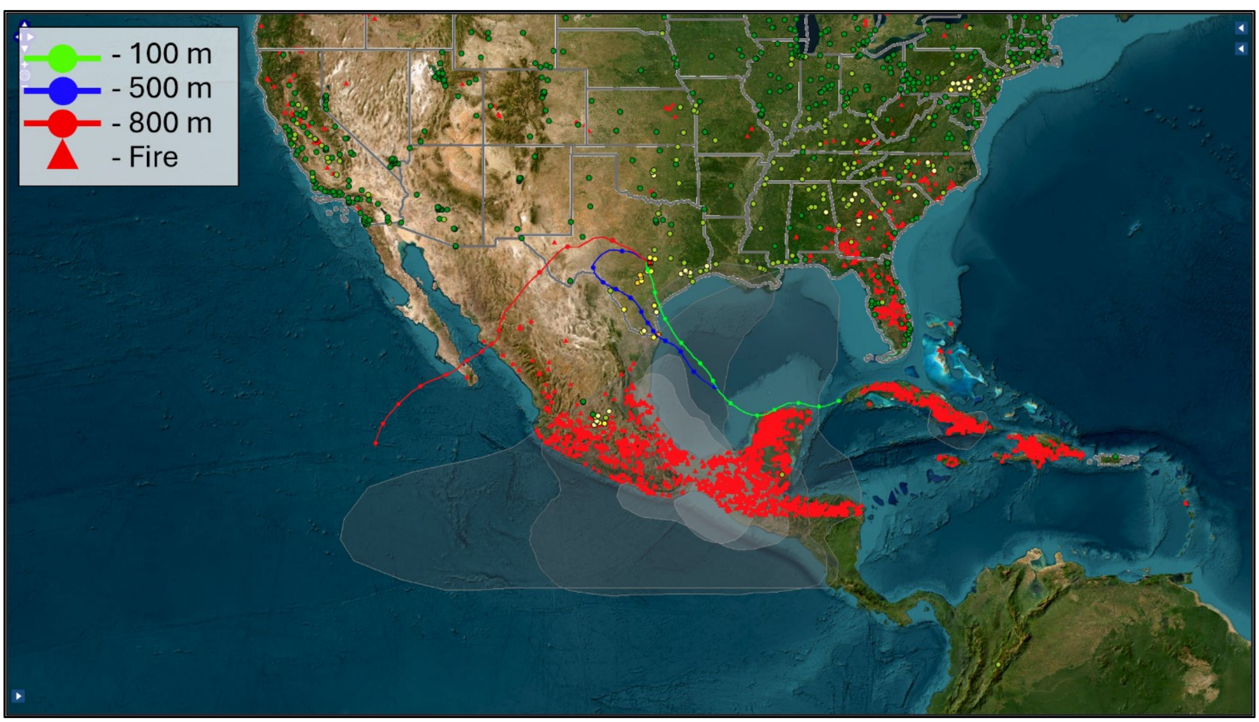


**Figure 3-26: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville Monitor on April 1, 2024**

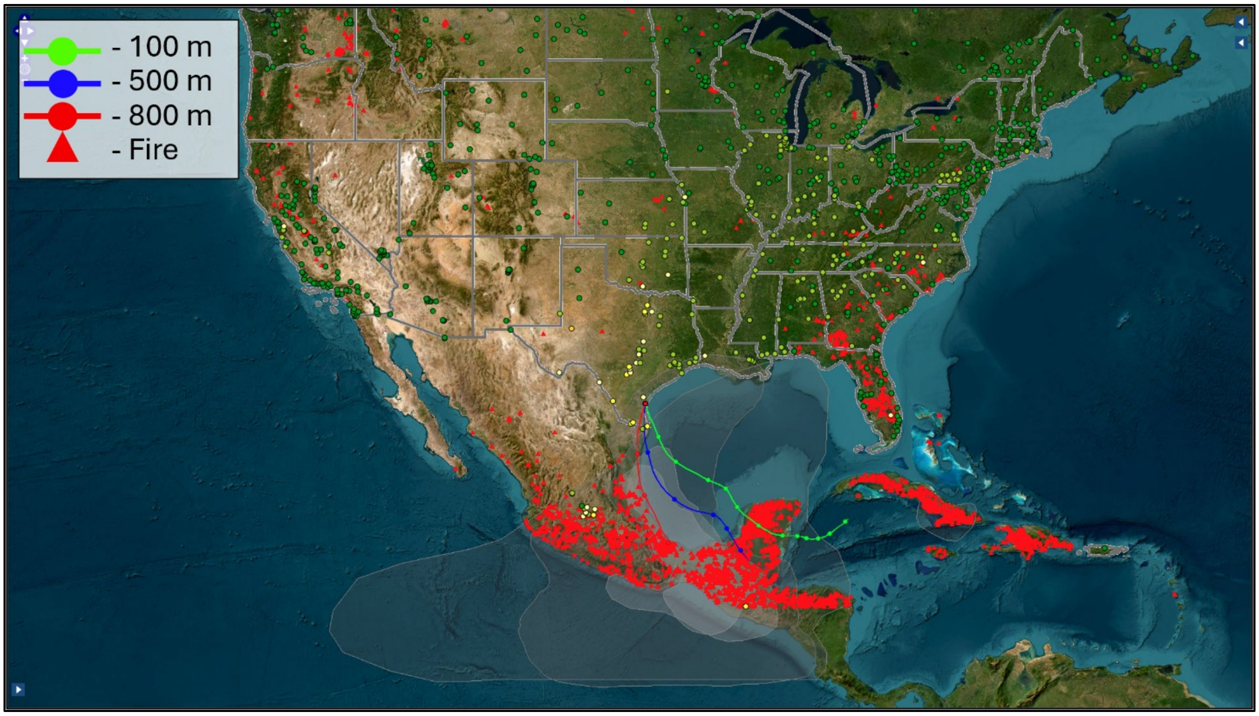

**Figure 3-27: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on April 1, 2024**

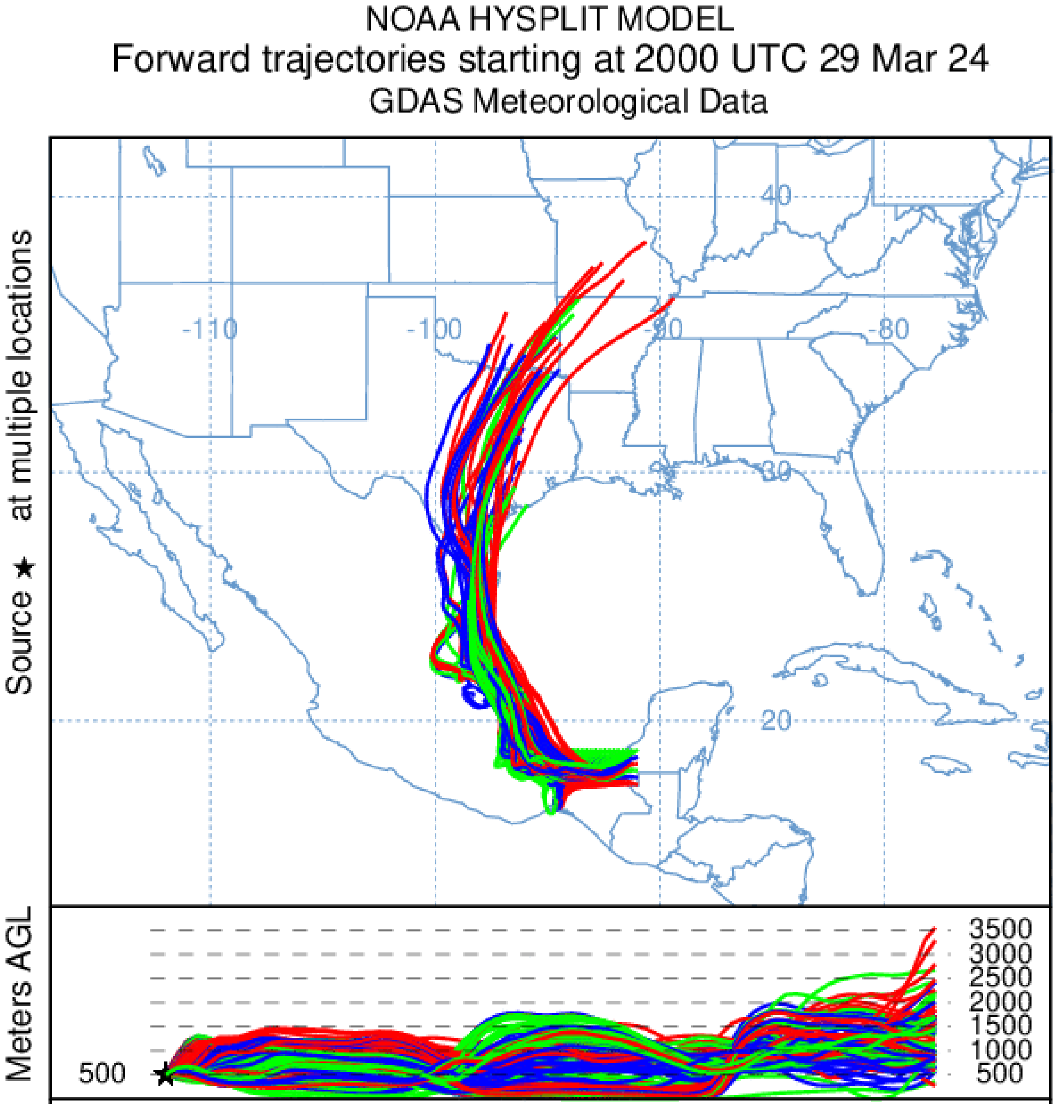


**Figure 3-28: NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting on March 29, 2024**

### 3.2.7 Group 7 – Evidence for April 4 through 6, 2024, Prescribed Fires for the Karnack Monitor

April 4 through April 6, 2024, were identified as Tier 1 days at the Karnack monitor due to smoke from prescribed fires. The daily average $PM_{2.5}$ concentrations were 129.1 µg/m$^3$, 188.1 µg/m$^3$, and 80.2 µg/m$^3$. Figure 3-29: *Hourly $PM_{2.5}$ Concentrations on April 4, 2024, Compared to Typical Concentrations at the Karnack Monitor*, Figure 3-30: *Hourly $PM_{2.5}$ Concentration on April 5, 2024, Compared to Typical Concentrations at the Karnack Monitor*, and Figure 3-31: *Hourly $PM_{2.5}$ Concentrations on April 6, 2024 Compared to Typical Concentrations at the Karnack Monitor*, show that on the first two successive evenings $PM_{2.5}$ concentrations reached very high levels, lingering into April 6, 2024, long enough to create a third high daily $PM_{2.5}$ average.

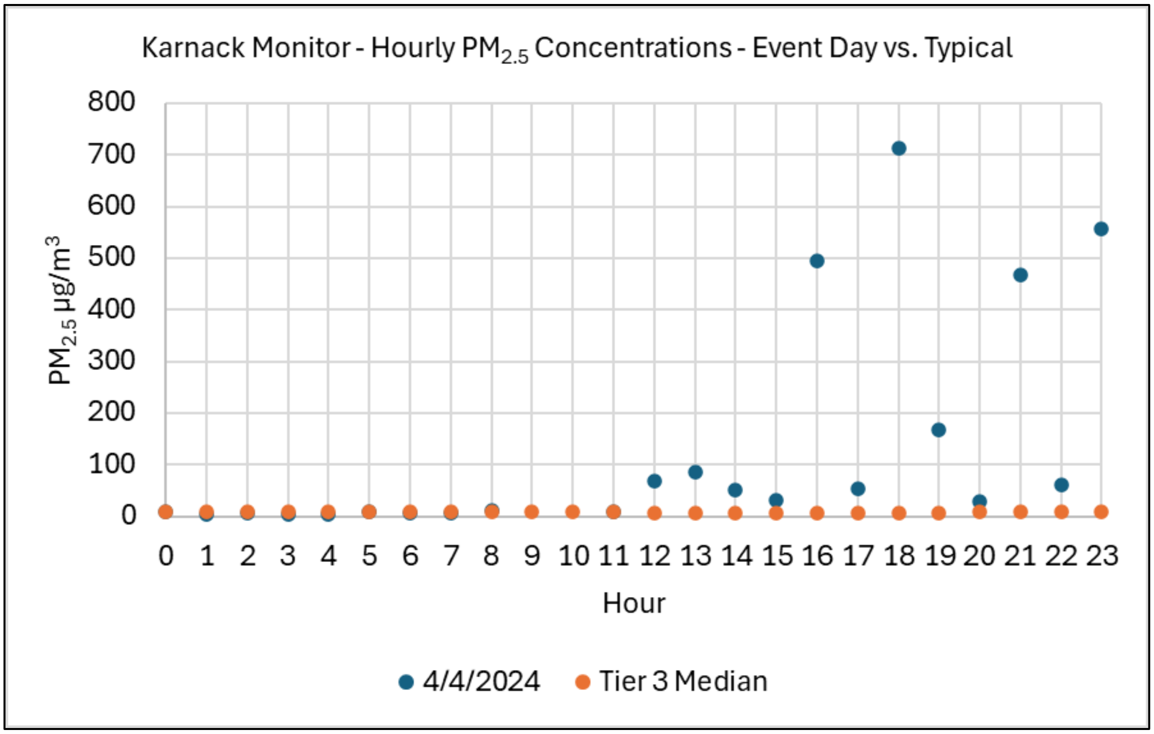


**Figure 3-29: Hourly $PM_{2.5}$ Concentrations on April 4, 2024, Compared to Typical Concentrations at the Karnack Monitor**

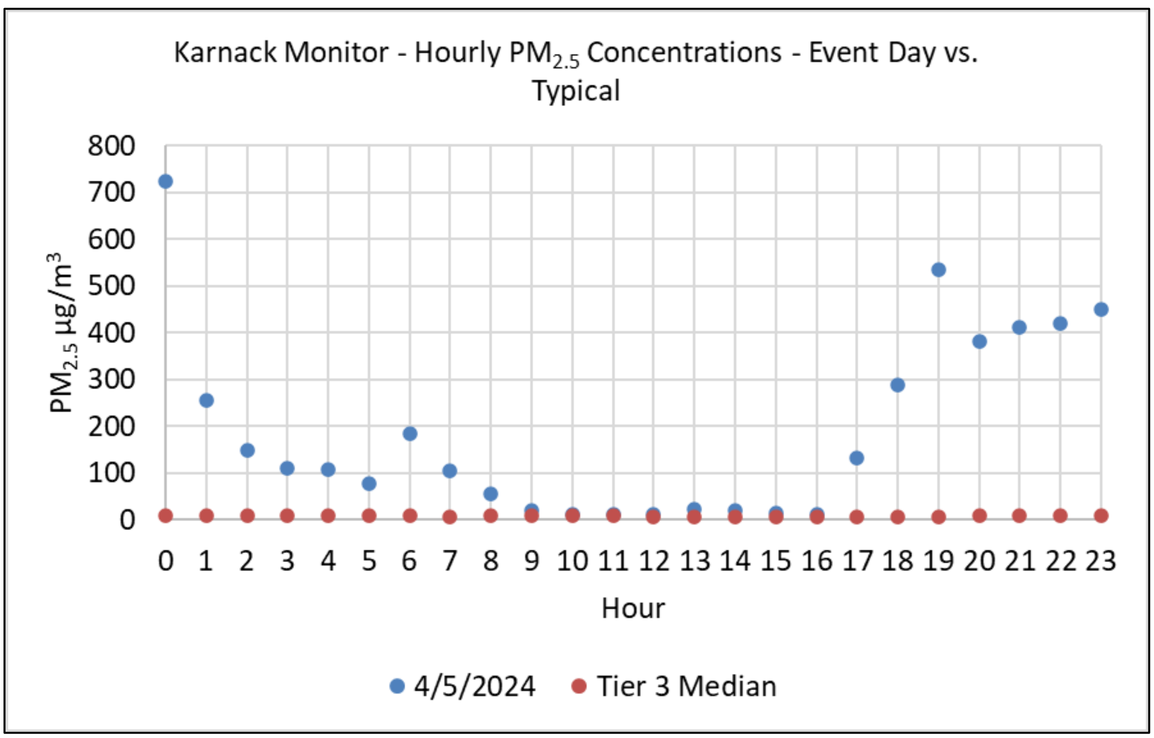


**Figure 3-30: Hourly $PM_{2.5}$ Concentration on April 5, 2024, Compared to Typical Concentrations at the Karnack Monitor**

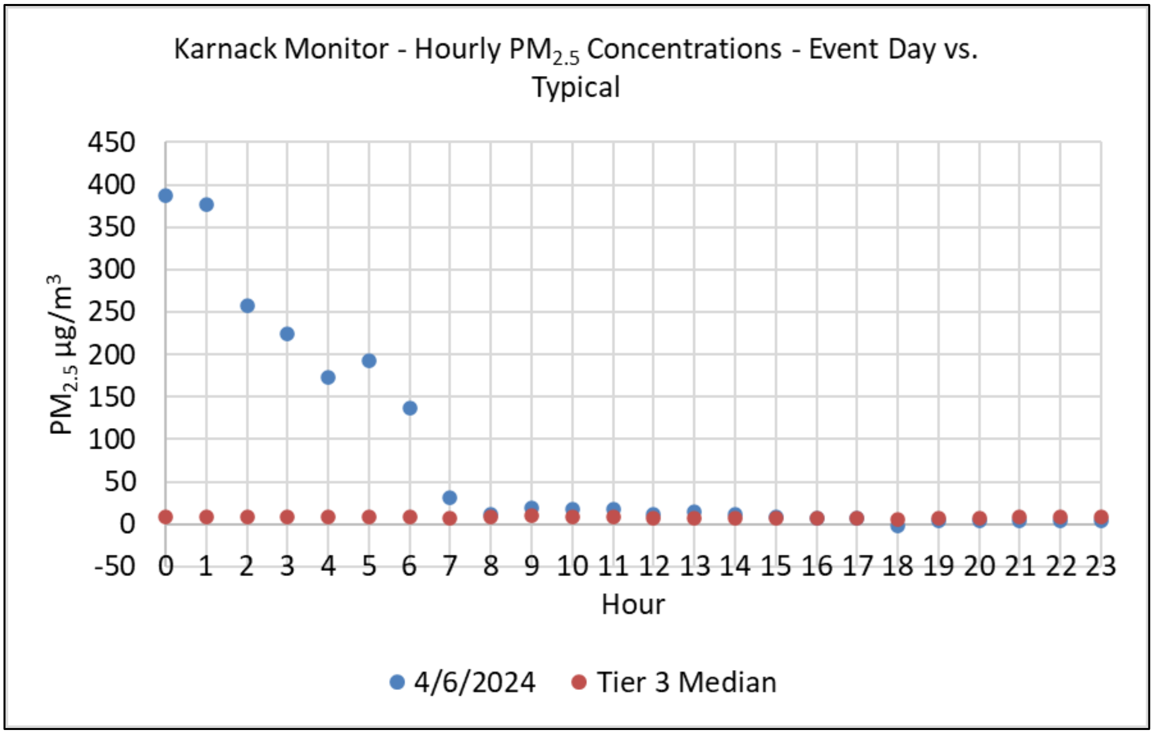


**Figure 3-31: Hourly $PM_{2.5}$ Concentrations on April 6, 2024 Compared to Typical Concentrations at the Karnack Monitor**

The source of these high concentrations is a series of three prescribed burns reported by the Texas Forest Service and the Caddo Lake National Wildlife Reserve. Figure 3-32: *Location of Prescribed Fires on April 4 through 6, 2024, Relative to the Karnack Monitoring Site* shows how close the burned parcels (light green polygons) are to the Karnack monitoring site (red placemark). Figure 3-33: *Terra/MODIS Corrected Reflectance (True Color) Satellite Imagery from April 5, 2025, Showing Location of Fire Location and Smoke Plume Relative to the Karnack Monitor* shows a fire detection close to the monitoring site collected by the VIIRS (375m) instrument on GOES-20 and a smoke plume blowing to the northwest collected by the MODIS (Corrected True Color) instrument on the TERRA satellite. Due to the shorter distance of the monitoring site to the of the fires, a wind rose plot (Figure 3-34: *Wind Rose for April 4, 2024, through April 6, 2024, at the Karnack Monitor*) is used to show that most winds were light and likely transported smoke in from nearby prescribed burning sites located at Caddo Lake.

Figure 3-32: Location of Prescribed Fires on April 4 through 6, 2024, Relative to the Karnack Monitoring Site

Figure 3-33: Terra/MODIS Corrected Reflectance (True Color) Satellite Imagery from April 5, 2025, Showing Location of Fire Location and Smoke Plume Relative to the Karnack Monitor

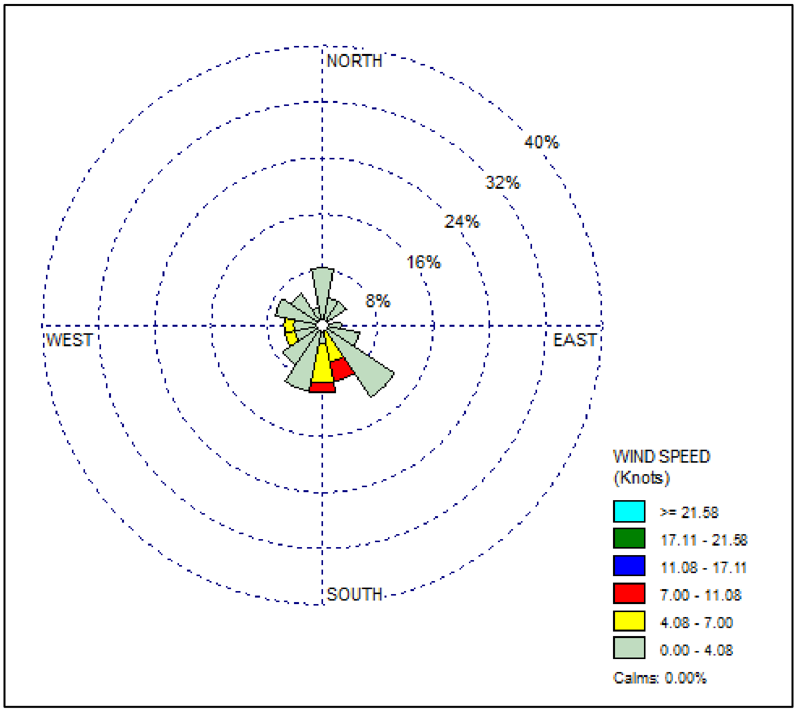


**Figure 3-34: Wind Rose for April 4, 2024, through April 6, 2024, at the Karnack Monitor**

### 3.2.8 Group 8 – Evidence for April 17 and 18, 2024, Fire (Mexico/Central America) $PM_{2.5}$ Event for the Webberville Monitor

April 17 and 18, 2024, were identified as Tier 2 days at the Webberville monitor due to smoke from fires in Mexico/Central America. The daily $PM_{2.5}$ average concentration was 23.8 µg/m$^3$ and 24.6 µg/m$^3$. Figure 3-35: *Hourly $PM_{2.5}$ Concentrations for April 17, 2024, Compared to Typical Concentrations at the Webberville Monitor* and Figure 3-36: *Hourly $PM_{2.5}$ Concentrations for April 18, 2024, Compared to Typical Concentrations at the Webberville Monitor* show the difference between hourly $PM_{2.5}$ concentrations on these two event days versus hourly concentrations on a normal day.

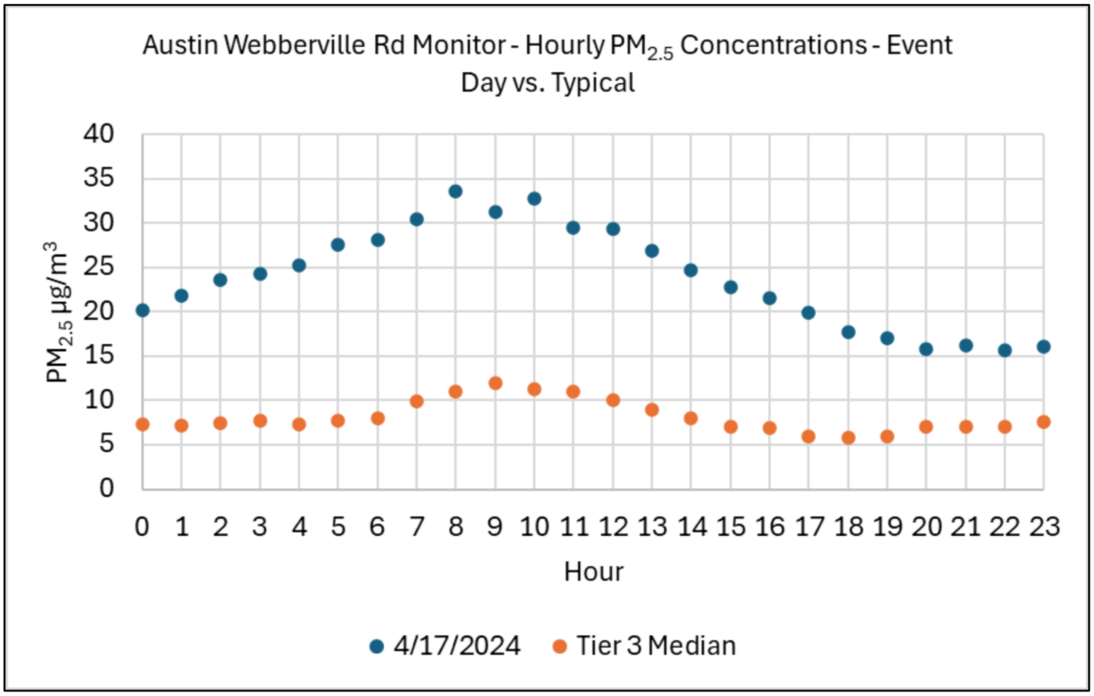


**Figure 3-35: Hourly $PM_{2.5}$ Concentrations for April 17, 2024, Compared to Typical Concentrations at the Webberville Monitor**

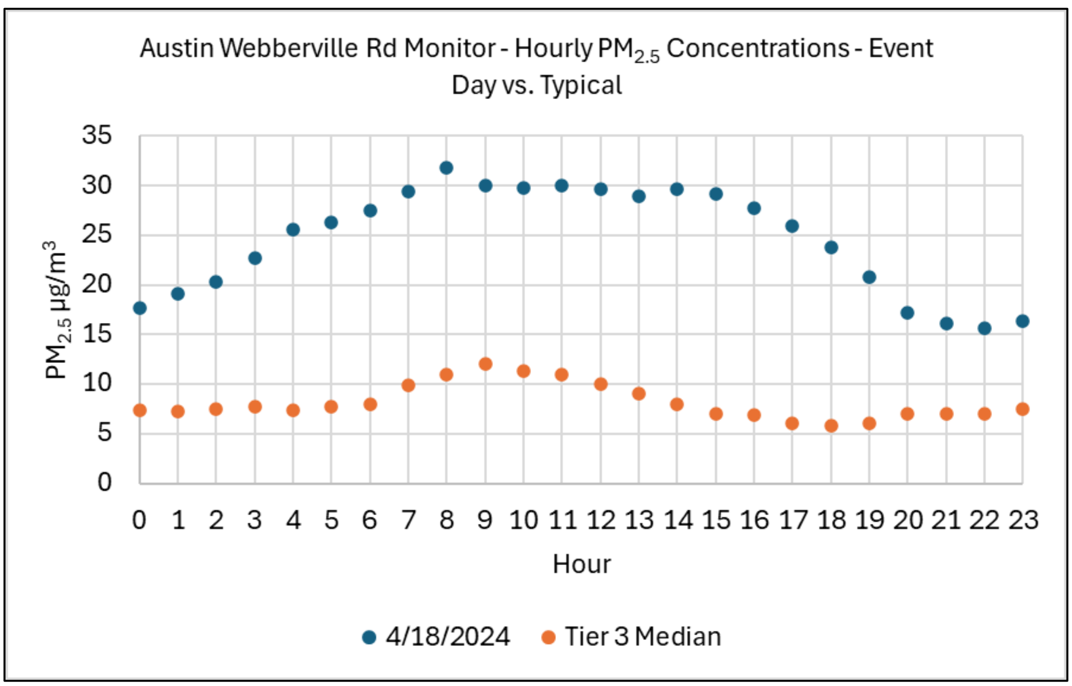


**Figure 3-36: Hourly $PM_{2.5}$ Concentrations for April 18, 2024, Compared to Typical Concentrations at the Webberville Monitor**

TCEQ forecast discussions (Table C-7) for April 17 and 18, 2024, discuss the influence of seasonal fire activities from central-southern Mexico, Central America, as well as the Yucatan Peninsula. Figure 3-37: *AirNow HMS Smoke Plumes for April 17, 2024* and Figure 3-38: *AirNow HMS Smoke Plumes for April 18, 2024*, support the accuracy of TCEQ's forecast and display the extent of smoke plumes across the Gulf of America and Texas. Back trajectories (Figure 3-39:

*AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville Monitor on April 17, 2024,* and Figure 3-40: *AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville Monitor on April 18, 2024*) show the transport paths from fires and through smoke plumes to the Webberville monitor. The HYSPLIT forward trajectory starting on April 15, 2024, and showing the path the air parcel took prior to reach the end points on April 18, 2024 (Figure 3-41: *NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting on April 15, 2024*) further confirm that $PM_{2.5}$ was transported to the Webberville monitor from the Yucatan Peninsula in Mexico.

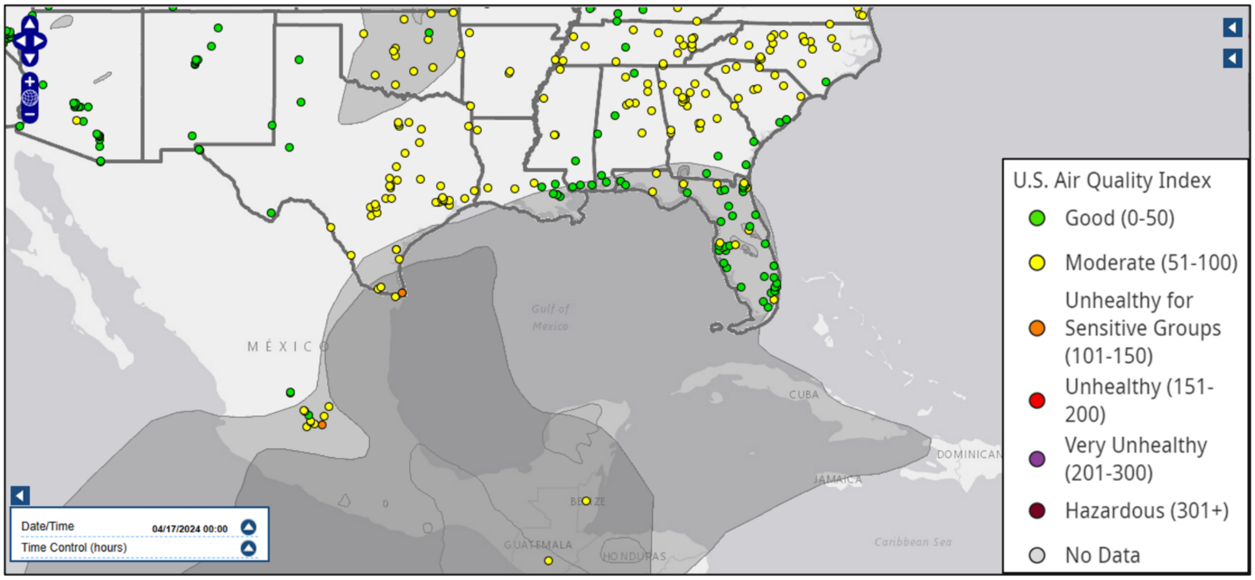


**Figure 3-37: AirNow HMS Smoke Plumes for April 17, 2024**

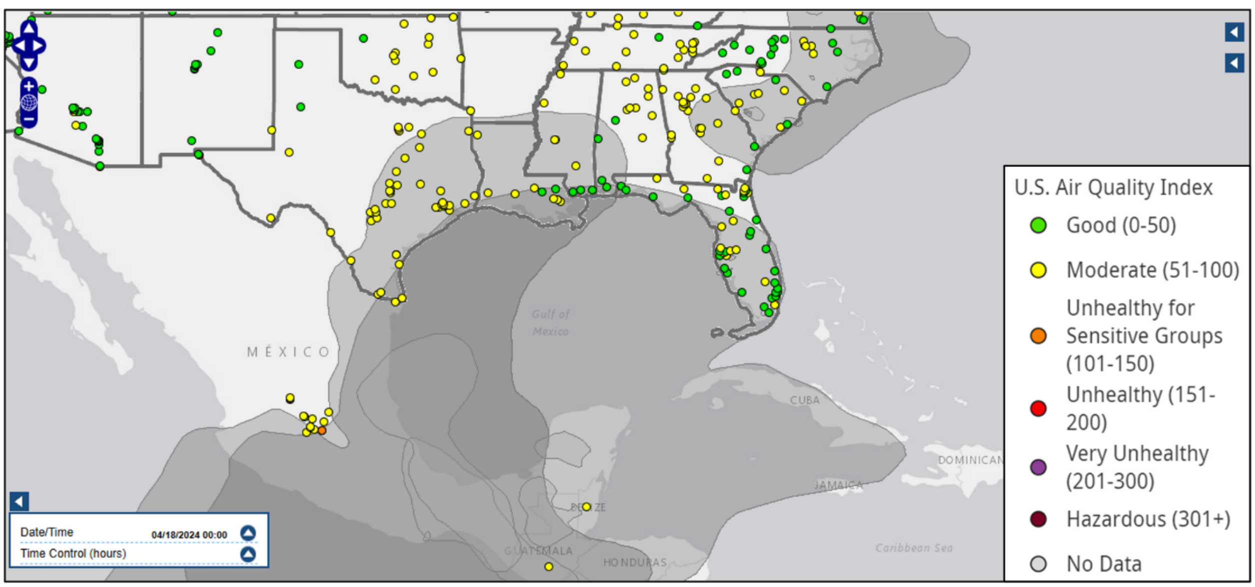


**Figure 3-38: AirNow HMS Smoke Plumes for April 18, 2024**

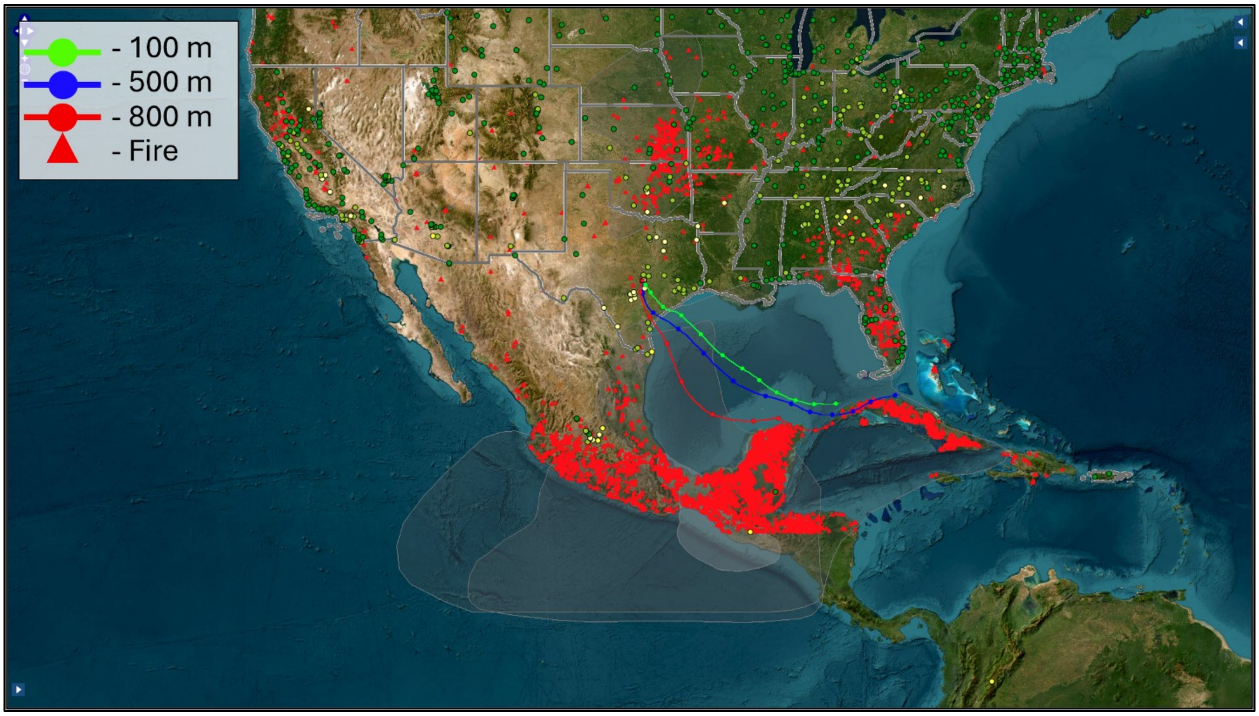


**Figure 3-39: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville Monitor on April 17, 2024**


**Figure 3-40: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville Monitor on April 18, 2024**

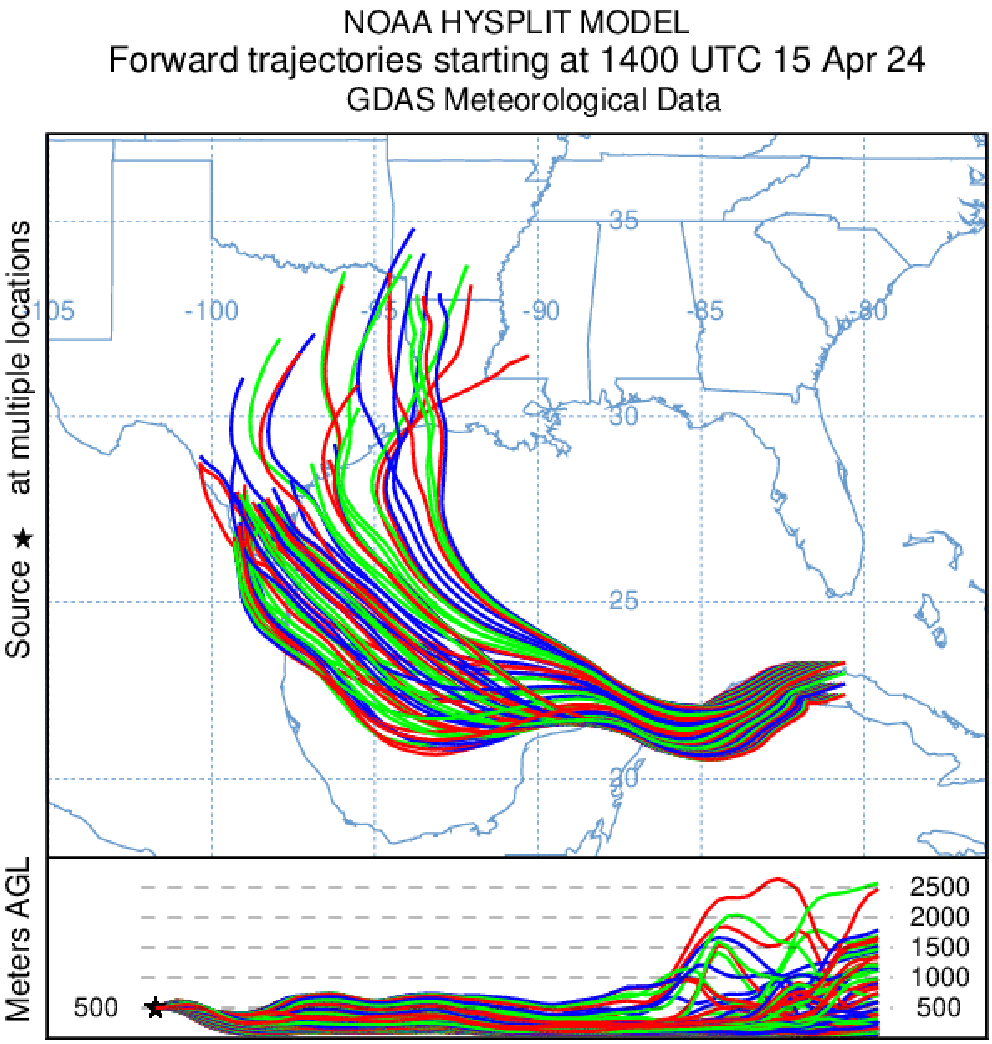


**Figure 3-41: NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting on April 15, 2024**

### 3.2.9 Group 9 – Evidence for April 26 through 28, 2024, Fire (Mexico/Central America) $PM_{2.5}$ Event for the Webberville and National Seashore Monitors

April 26 through April 28, 2024, were identified as Tier 2 days (April 27 and April 28, 2024) for the National Seashore monitor and Tier 1 (April 27, 2028) and Tier 2 (April 26, 2024) days for the Webberville monitor. TCEQ forecast discussions (Table C-8) for April 26 through 28, 2024, reference the presence of higher levels of $PM_{2.5}$ across the southern and central portions of Texas. Figure 3-42: *Hourly $PM_{2.5}$ Concentrations on April 26, 2024, Compared to Typical Concentrations at* the Webberville Monitor, Figure 3-43: *Hourly PM2.5 Concentrations on April 27, 2024, Compared to Typical Concentrations at the Webberville Monitor*, Figure 3-44: *Hourly $PM_{2.5}$ Concentrations on April 27, 2024, Compared to Typical Concentrations at the* National Seashore Monitor, and Figure 3-45: *Hourly $PM_{2.5}$ Concentrations on April 28, 2024, Compared to Typical Concentrations at the National Seashore Monitor*, show that $PM_{2.5}$ concentrations were consistently high over this three-day period, as forecast by the TCEQ.

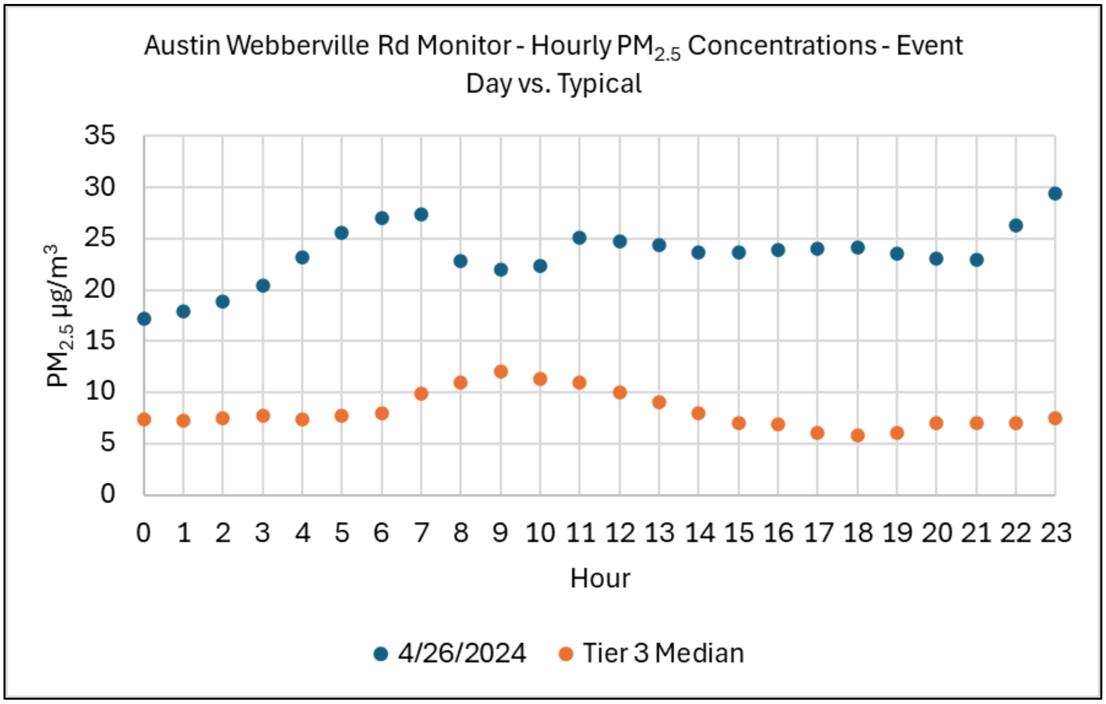


**Figure 3-42: Hourly $PM_{2.5}$ Concentrations on April 26, 2024, Compared to Typical Concentrations at the Webberville Monitor**

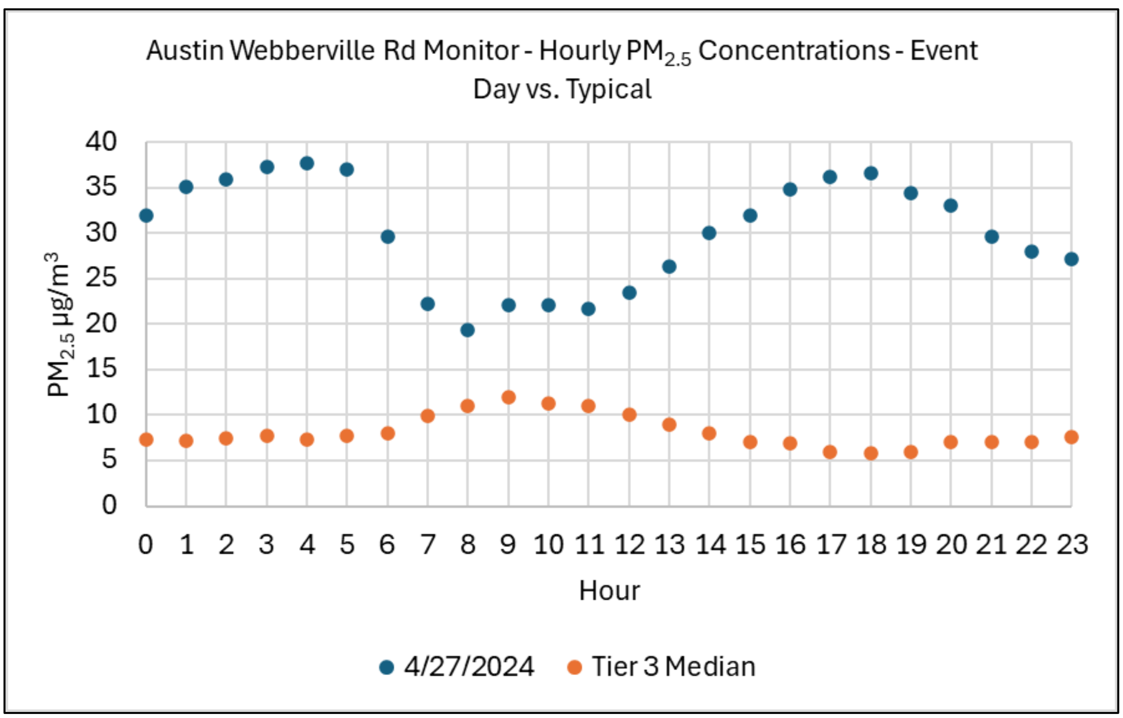


**Figure 3-43: Hourly $PM_{2.5}$ Concentrations on April 27, 2024, Compared to Typical Concentrations at the Webberville Monitor**

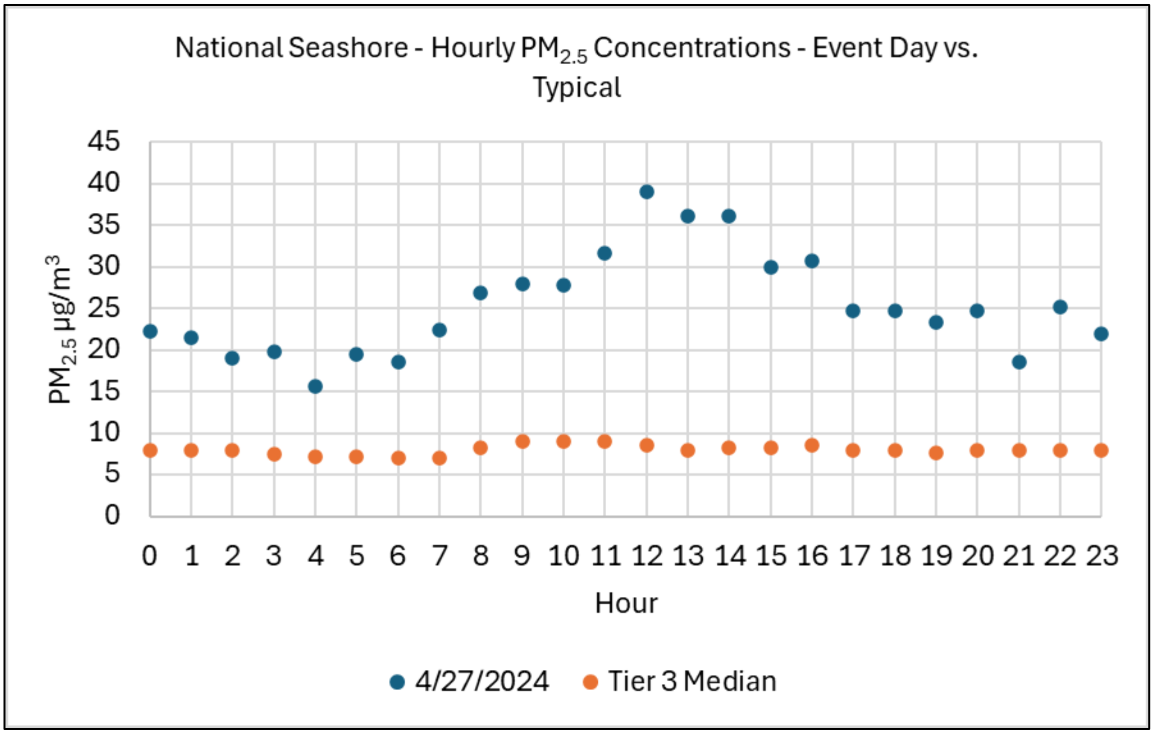


**Figure 3-44: Hourly $PM_{2.5}$ Concentrations on April 27, 2024, Compared to Typical Concentrations at the National Seashore Monitor**

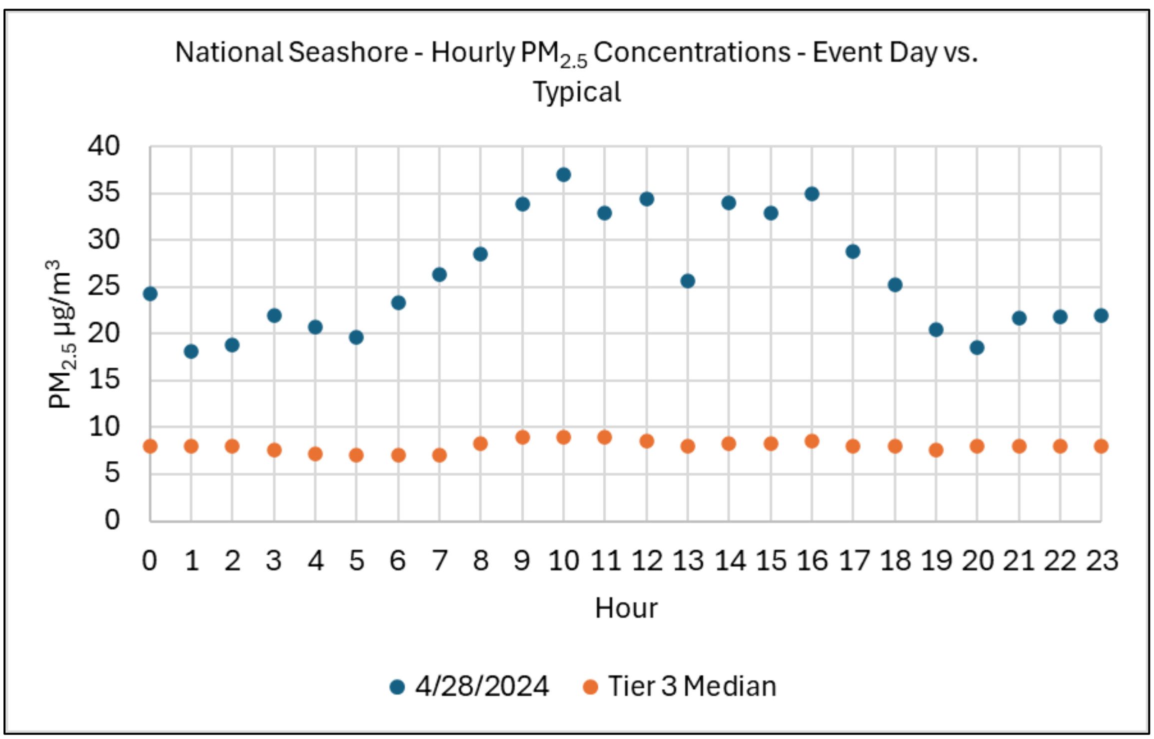


**Figure 3-45: Hourly $PM_{2.5}$ Concentrations on April 28, 2024, Compared to Typical Concentrations at the National Seashore Monitor**

Figure 3-46: *AirNow HMS Smoke Plume for April 26, 2024*, Figure 3-47: *AirNow HMS Smoke Plume for April 27, 2024*, and Figure 3-48: *AirNow HMS Smoke Plume for April 28, 2024*, show smoke plumes from Mexico covering both the Webberville and National Seashore monitors, resulting in Moderate AQI levels over both monitors. Figure 3-49: *AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville Monitor on April 26, 2024*, Figure 3-50: *AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville Monitor on April 27, 2024*, Figure 3-51: *AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on April 27, 2024*, and Figure 3-52: *AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on April 28, 2024*, show backward trajectories from both monitoring sites passing through smoke plumes and over areas with active wildfires in Mexico. Figure 3-55: *NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting on April 23, 2024*, Figure 3-56: *NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting on April 24, 2024*, and Figure 3-57: *NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting on April 25, 2024*, show forward trajectories passing through that same airspace on their way to the Webberville and National Seashore monitoring sites. Satellite imagery for April 27 and 28, 2024 (Figure 3-53: *Aqua/MODIS Corrected Reflectance (True Color) Satellite Imagery from April 27, 2024, Showing Haze in the Gulf of America and Cloud Clover Over South and Central Texas* and Figure 3-54: *Aqua/MODIS Corrected Reflectance (True Color) Satellite Imagery from April 28, 2024, Showing Haze in the Gulf of America and Cloud Clover Over South and Central Texas*) show the presence of haze in the Gulf of America and along the Texas coast.

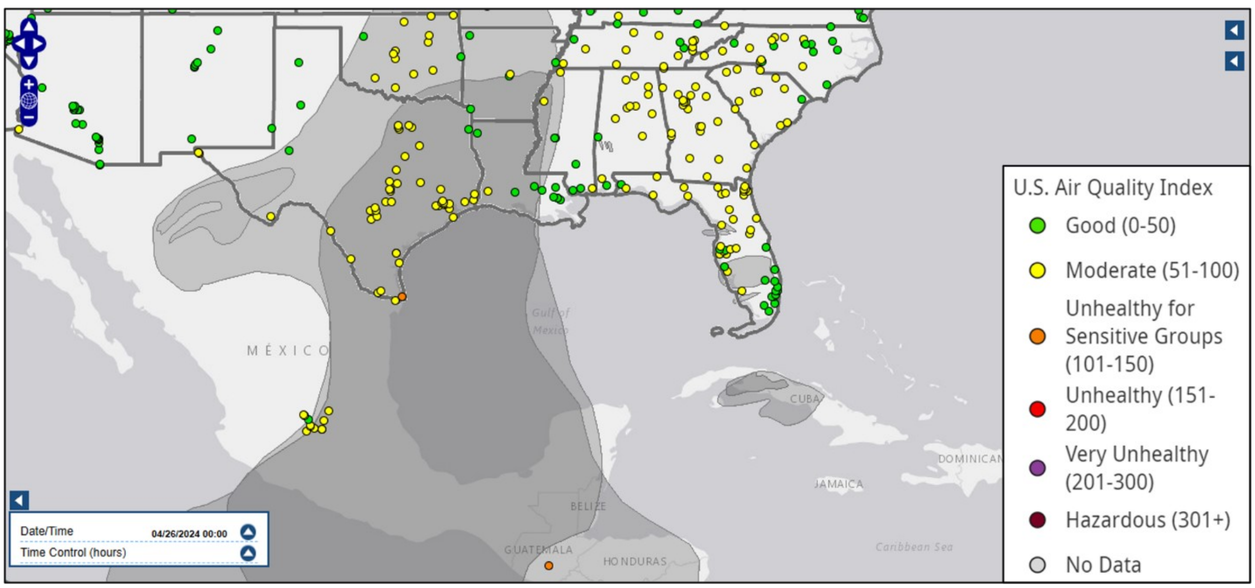


**Figure 3-46: AirNow HMS Smoke Plume for April 26, 2024**

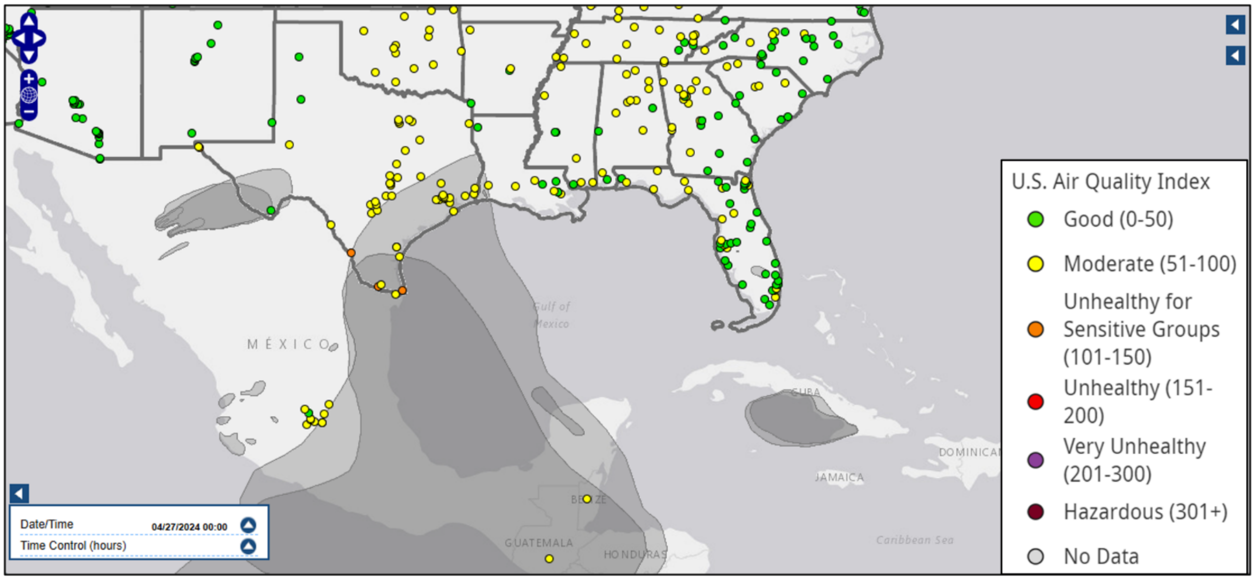

Figure 3-47: AirNow HMS Smoke Plume for April 27, 2024

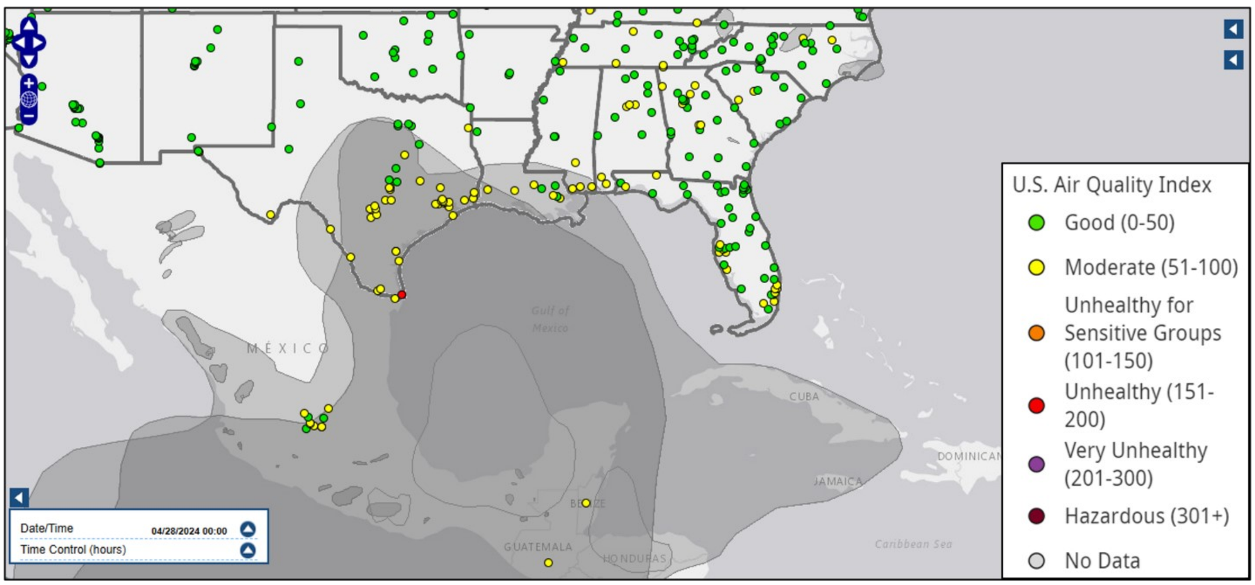

Figure 3-48: AirNow HMS Smoke Plume for April 28, 2024

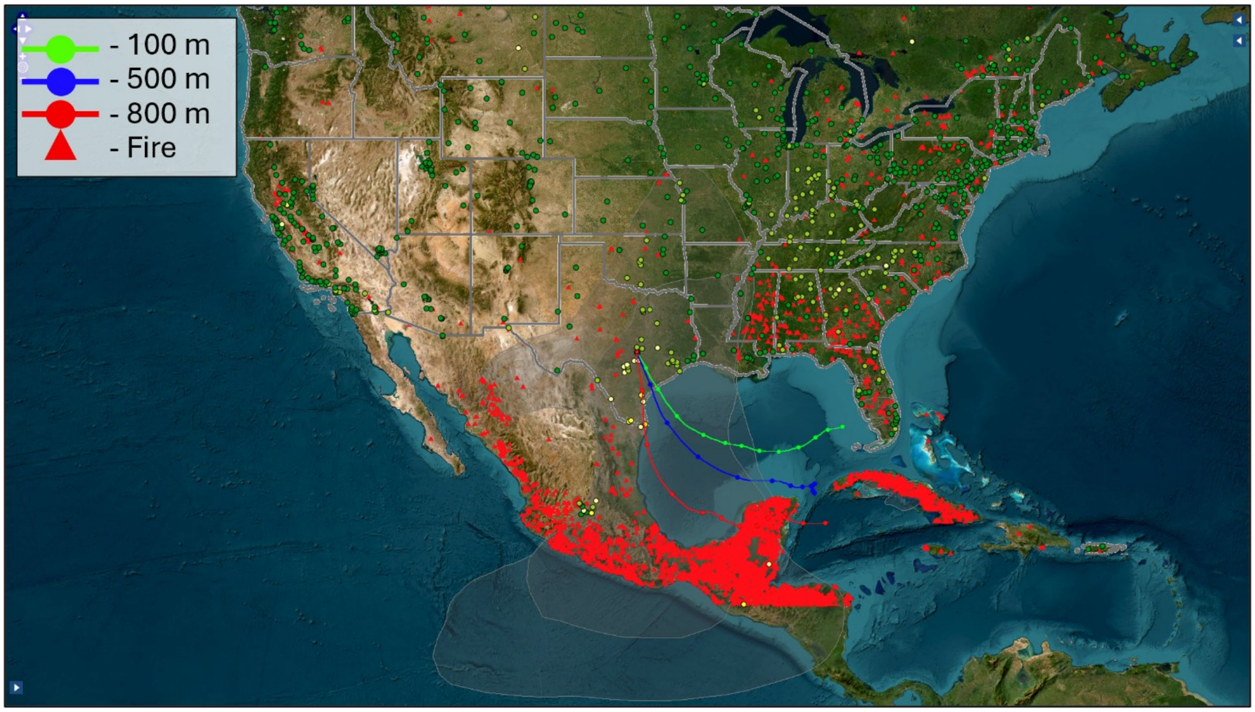

Figure 3-49: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville Monitor on April 26, 2024

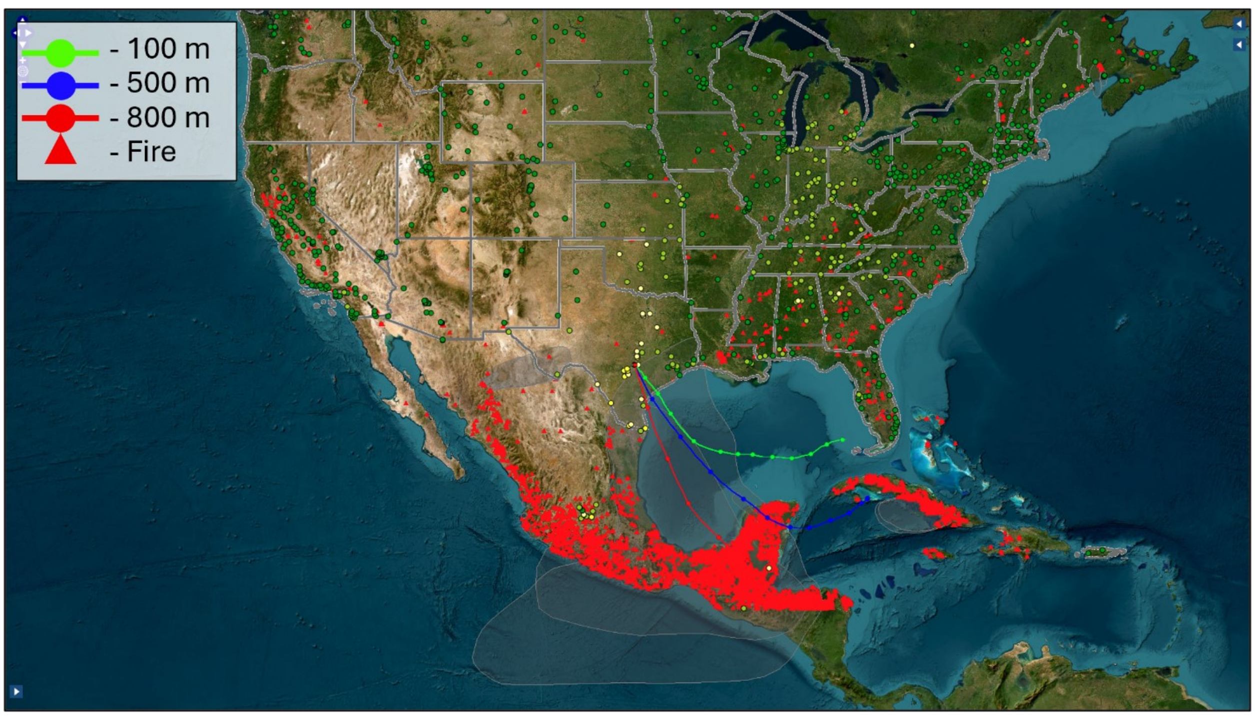

Figure 3-50: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville Monitor on April 27, 2024

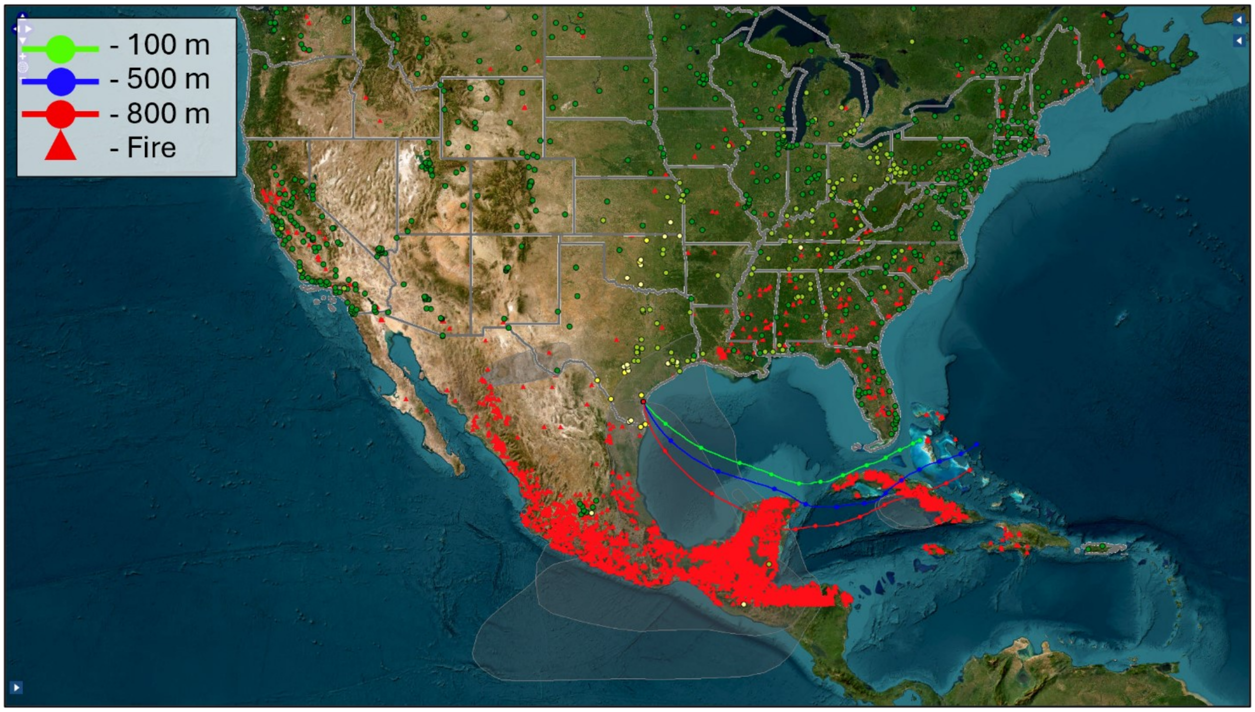

Figure 3-51: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on April 27, 2024

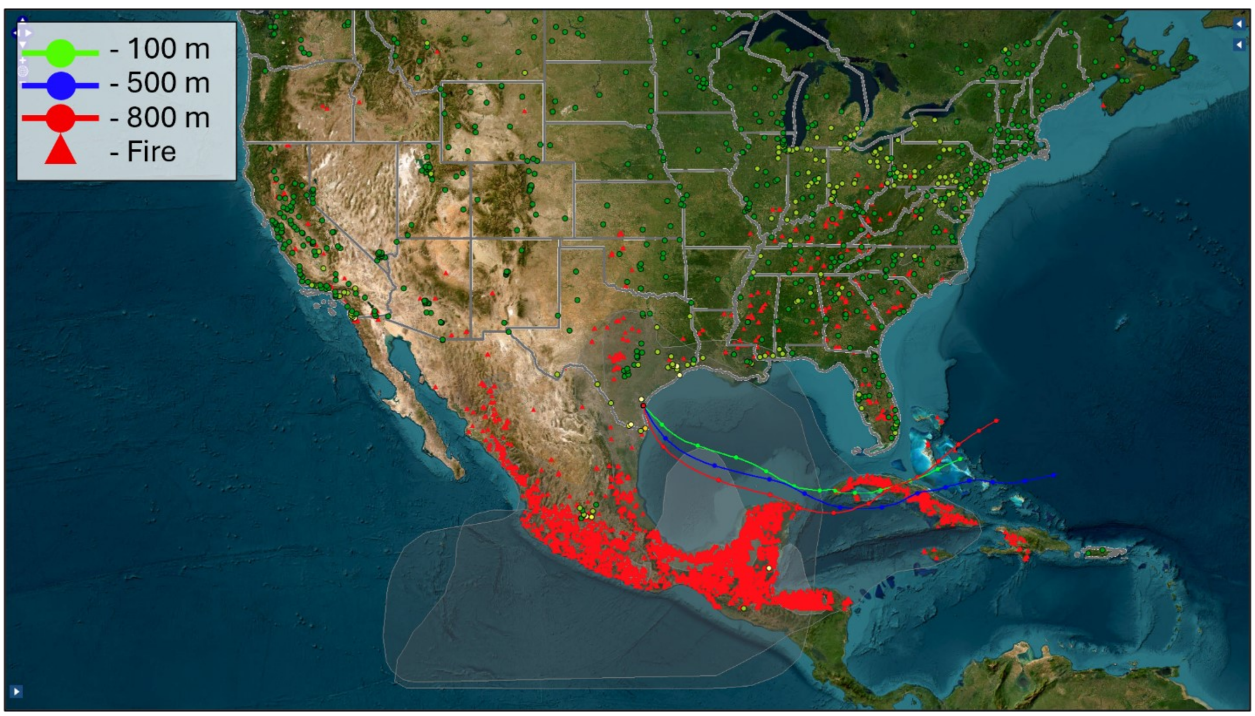

Figure 3-52: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on April 28, 2024

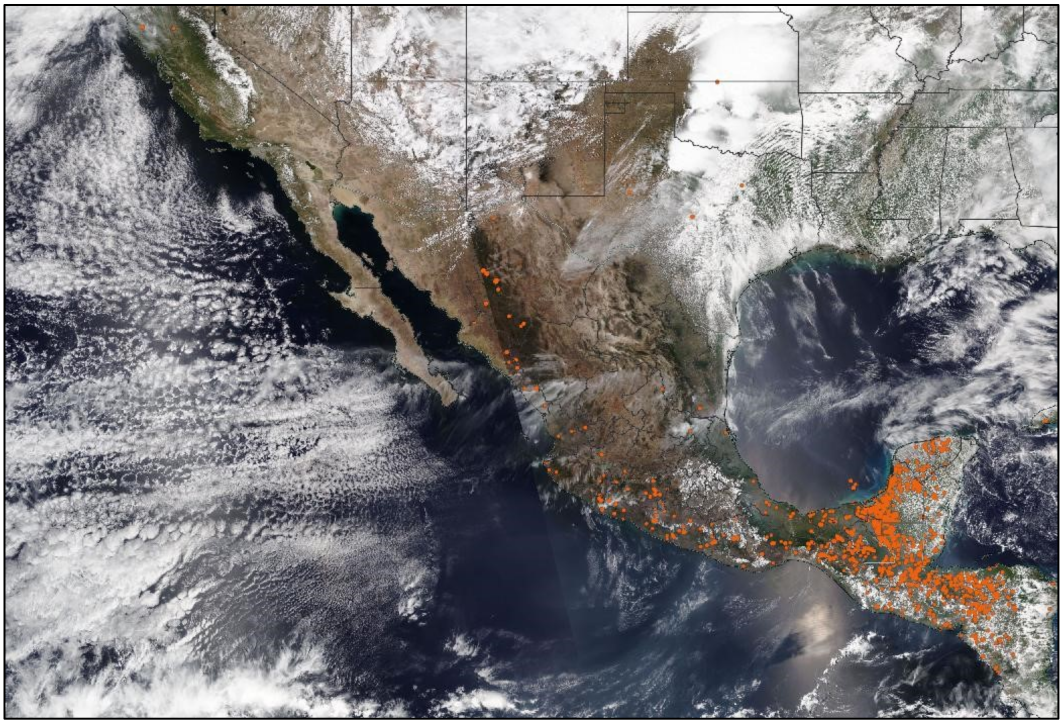

**Figure 3-53: Aqua/MODIS Corrected Reflectance (True Color) Satellite Imagery from April 27, 2024, Showing Haze in the Gulf of America and Cloud Clover Over South and Central Texas**

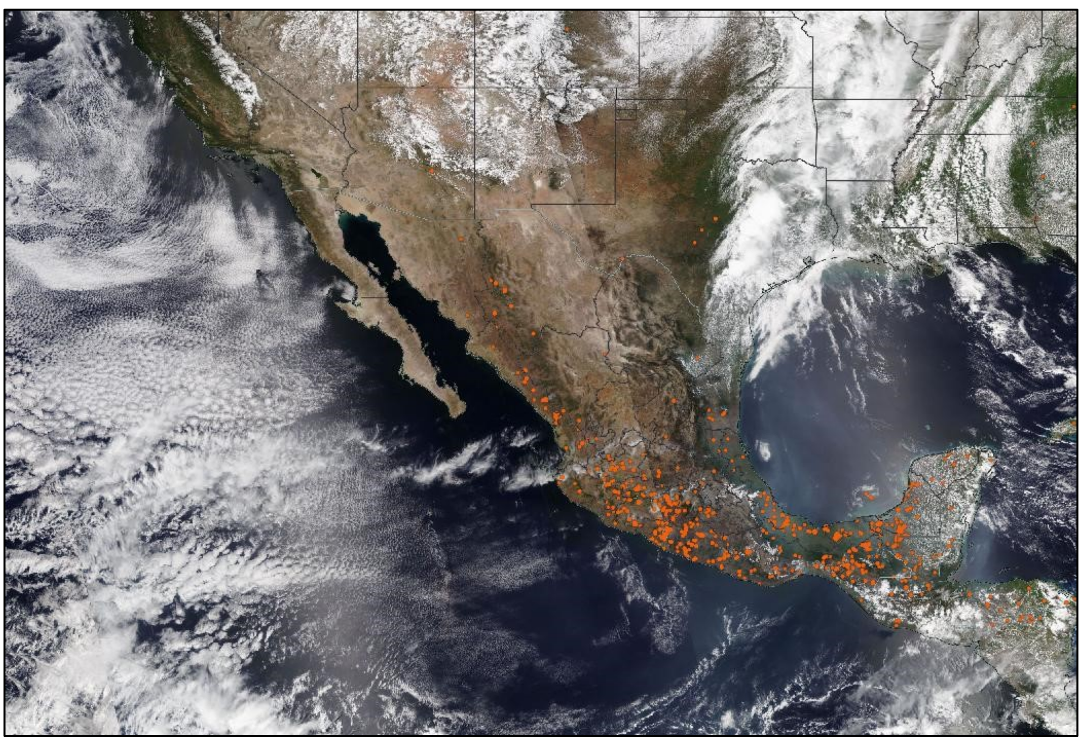

**Figure 3-54: Aqua/MODIS Corrected Reflectance (True Color) Satellite Imagery from April 28, 2024, Showing Haze in the Gulf of America and Cloud Clover Over South and Central Texas**

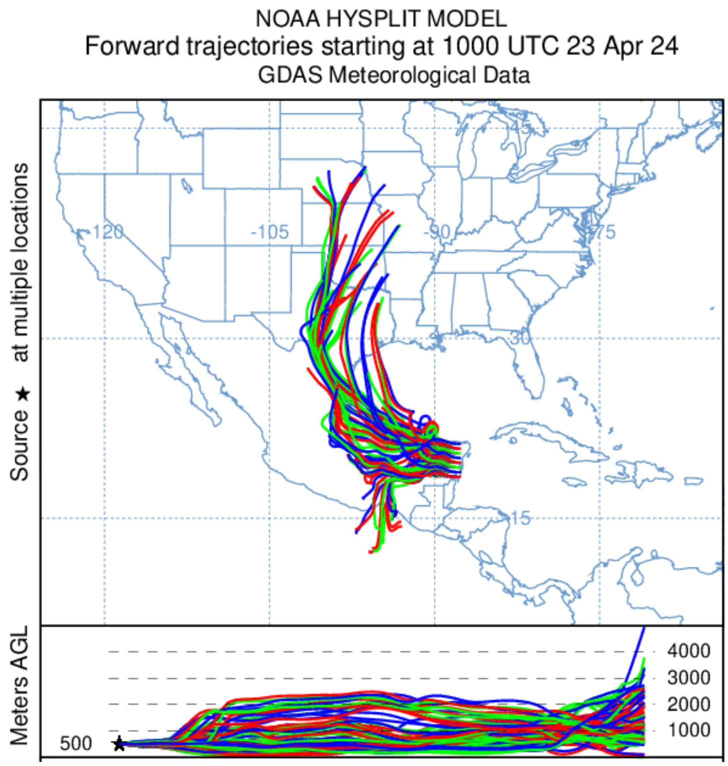


**Figure 3-55: NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting on April 23, 2024**

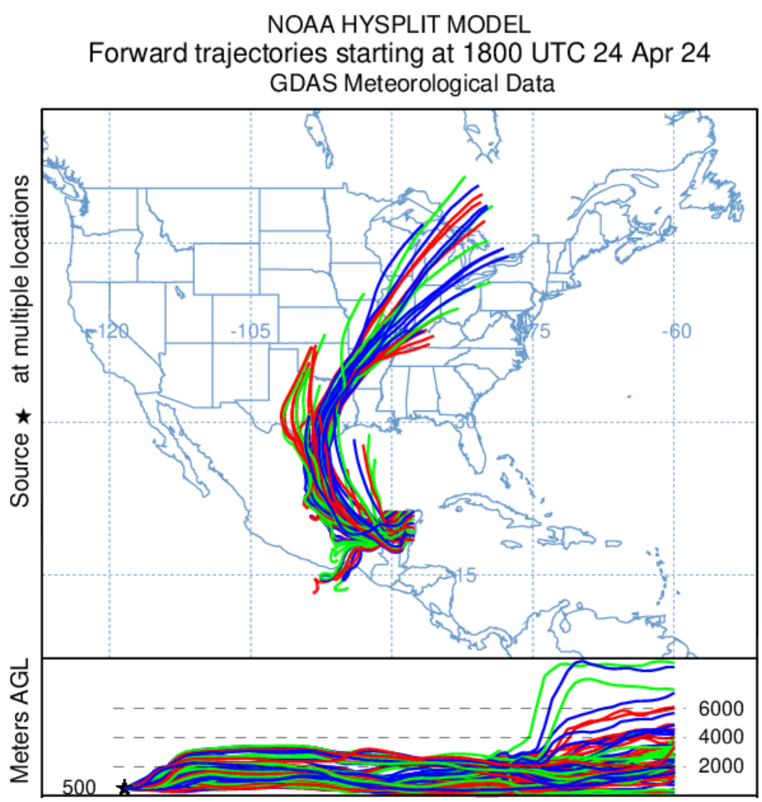


**Figure 3-56: NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting on April 24, 2024**

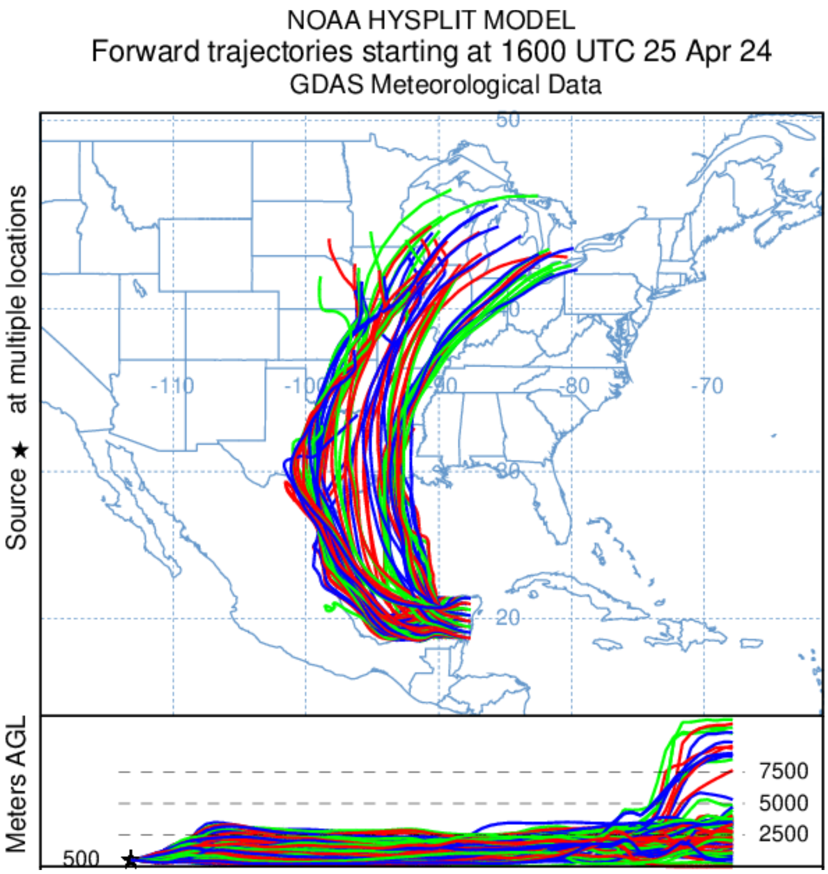

**Figure 3-57: NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting on April 25, 2024**

### 3.2.10 Group 10 – Evidence for May 7 through May 10, 2024, Fire (Mexico/Central America) for the Webberville, North Hills, and National Seashore Monitors

From May 7 through May 10, 2024, exceedances were observed at Webberville, North Hills, and National Seashore monitors that are attributable to fires from Mexico. Table 3-1: *Summary of Event Dates and Measurements for Group 10 Events* shows the daily average $PM_{2.5}$ concentrations and tiers for days in Group 10. Figure 3-58: *Hourly $PM_{2.5}$ Concentrations on May 7, 2024, Hourly $PM_{2.5}$ Concentrations on May 7, 2024, Compared to Typical Concentrations at the Webberville Monitor*, Figure 3-59: *Hourly $PM_{2.5}$ Concentrations on May 8, 2024, Compared to Typical Concentrations at the Webberville Monitor*, Figure 3-60: *Hourly $PM_{2.5}$ Concentrations on May 8, 2024, Compared to Typical Concentrations at the North Hills Monitor*, Figure 3-61: *Hourly $PM_{2.5}$ Concentrations on May 8, 2024, Compared to Typical Concentrations at the National Seashore Monitor*, Figure 3-62: *Hourly $PM_{2.5}$ Concentrations on May 9, 2024, Compared to Typical Concentrations at the Webberville Monitor*, Figure 3-63: *Hourly $PM_{2.5}$ Concentrations on May 9, 2024, Compared to Typical Concentrations at the National Seashore Monitor*, and Figure 3-64: *Hourly $PM_{2.5}$ Concentrations on May 10, 2024, Compared to Typical Concentrations at the National Seashore Monitor* show the daily average $PM_{2.5}$ on event days.

**Table 3-1: Summary of Event Dates and Measurements for Group 10 Events**

| Date | Site Name | Exceedance Concentration | Tier |
|---|---|---|---|
| 05/07/24 | Webberville | 28.5 | 2 |
| 05/08/24 | North Hills | 43.1 | 1 |

| Date | Site Name | Exceedance Concentration | Tier |
|---|---|---|---|
| 05/08/24 | Webberville | 51.8 | 1 |
| 05/08/24 | National Seashore | 32.8 | 1 |
| 05/09/24 | Webberville | 35.6 | 1 |
| 05/09/24 | National Seashore | 43.7 | 1 |
| 05/10/24 | National Seashore | 36.0 | 1 |

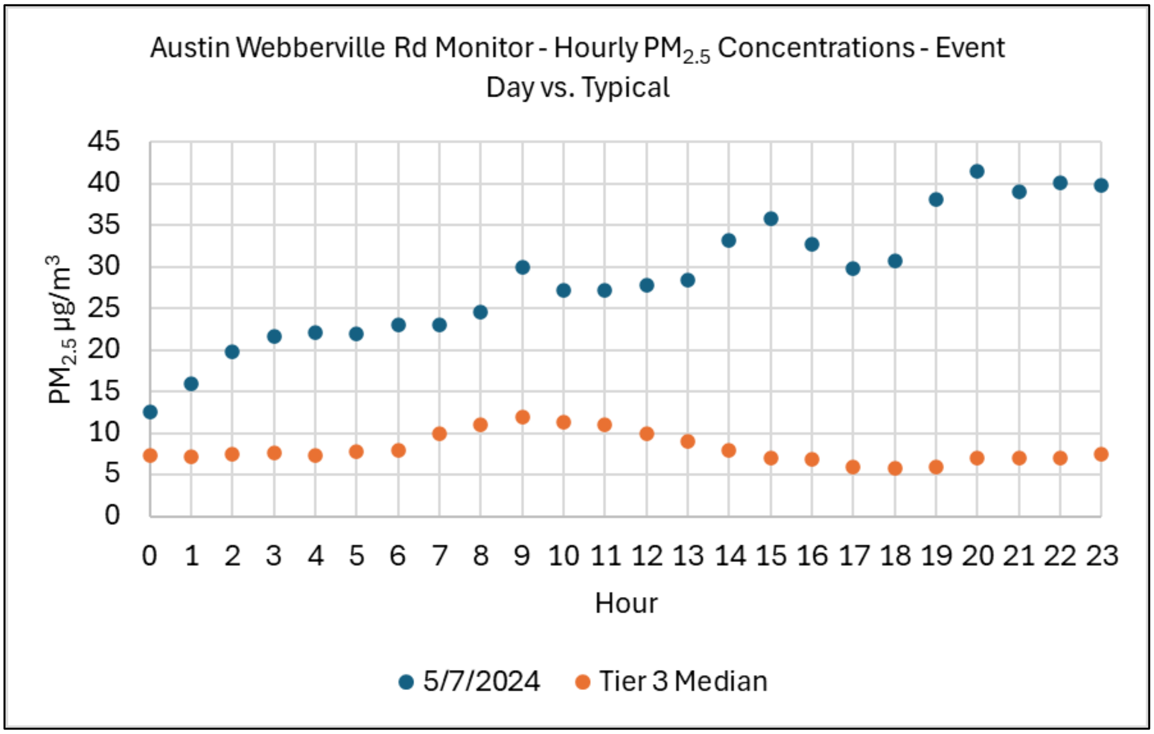


**Figure 3-58: Hourly $PM_{2.5}$ Concentrations on May 7, 2024, Hourly $PM_{2.5}$ Concentrations on May 7, 2024, Compared to Typical Concentrations at the Webberville Monitor**

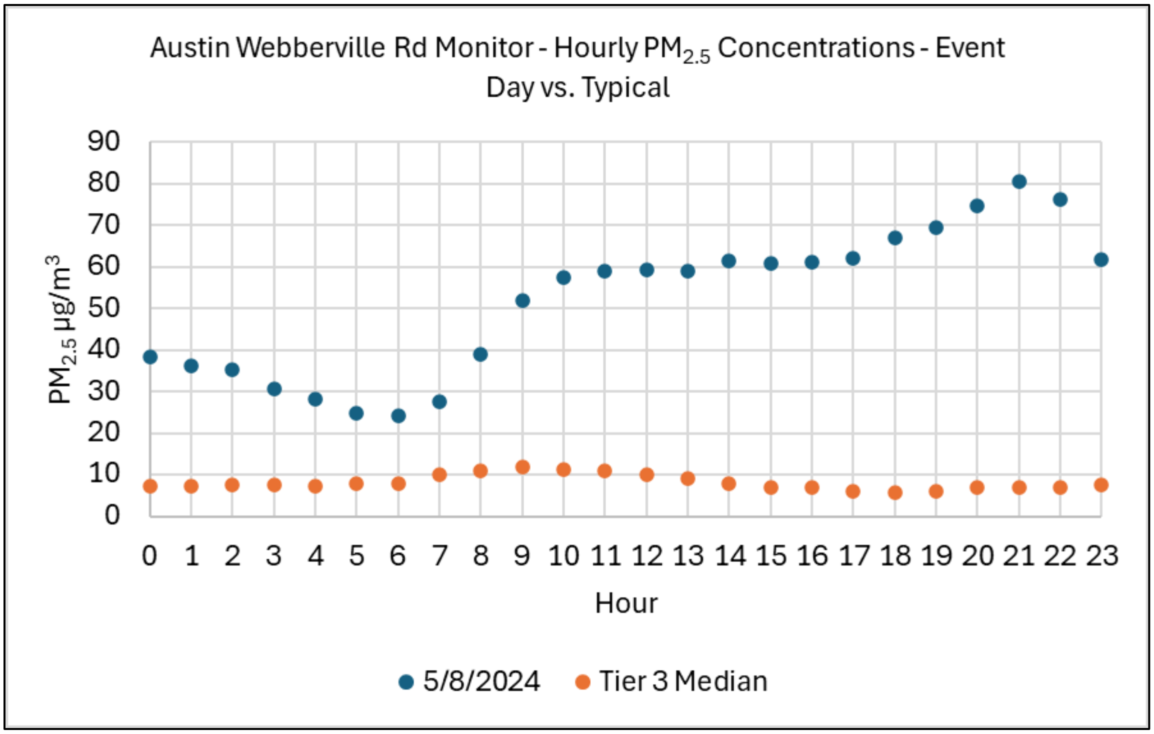


**Figure 3-59: Hourly $PM_{2.5}$ Concentrations on May 8, 2024, Compared to Typical Concentrations at the Webberville Monitor**

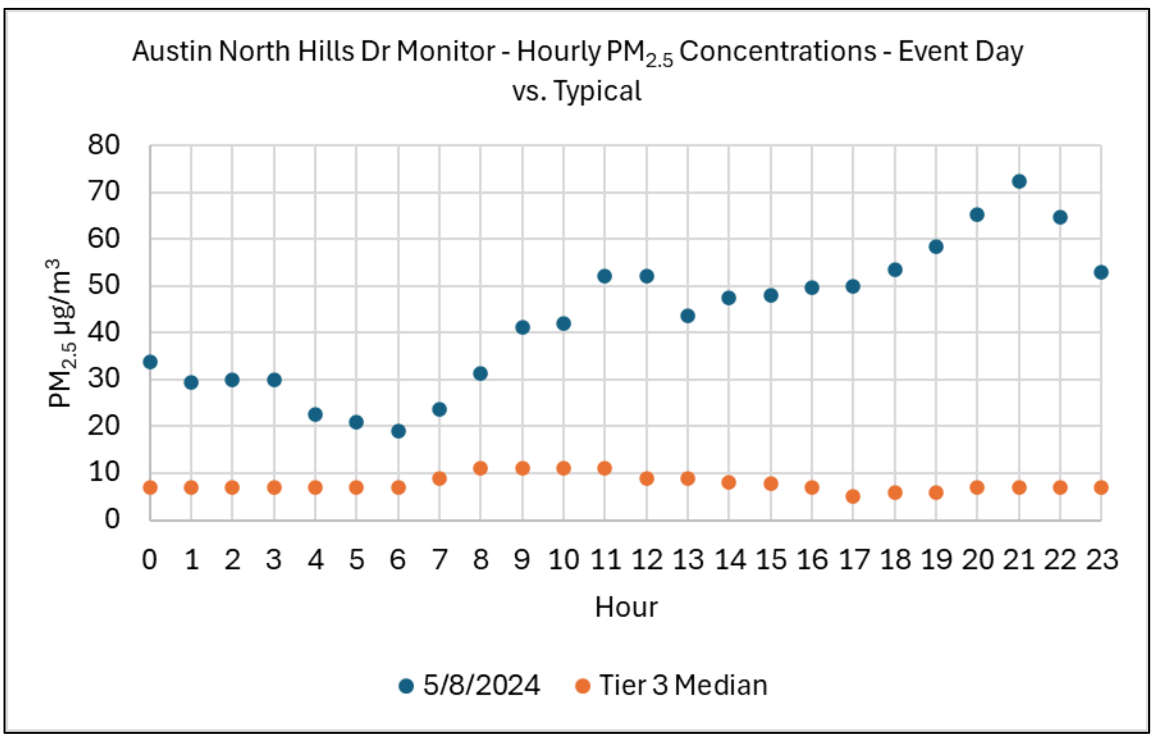


**Figure 3-60: Hourly $PM_{2.5}$ Concentrations on May 8, 2024, Compared to Typical Concentrations at the North Hills Monitor**

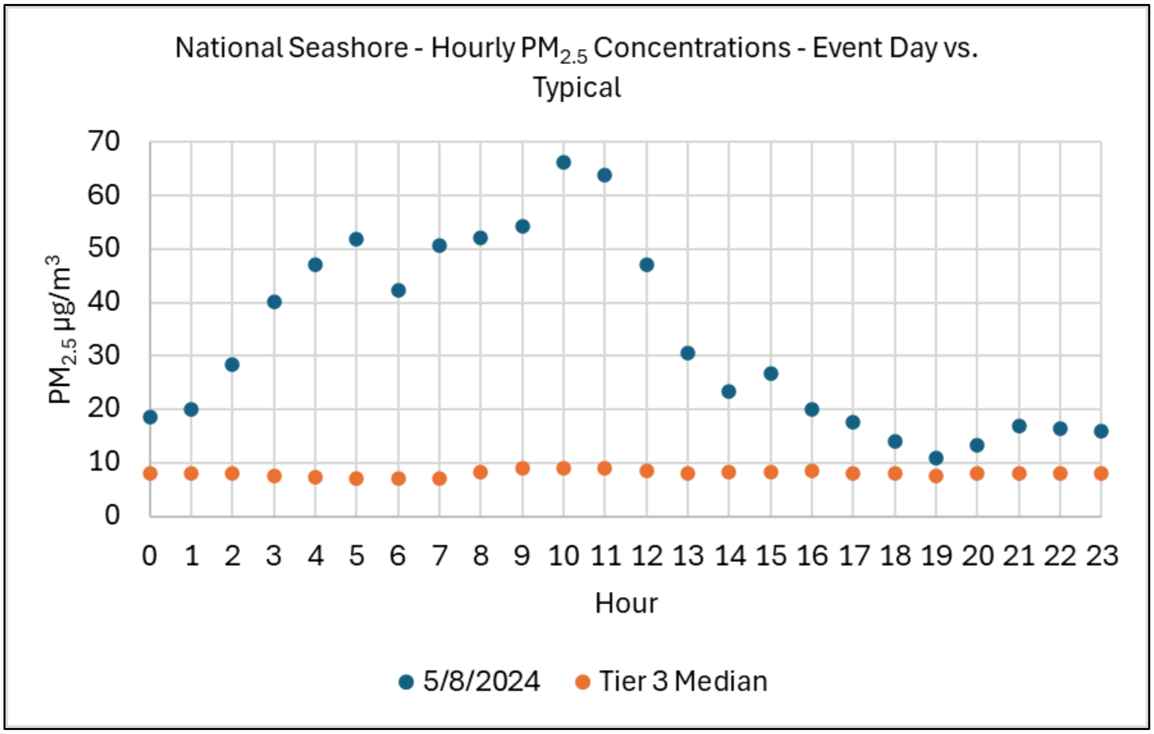


**Figure 3-61: Hourly $PM_{2.5}$ Concentrations on May 8, 2024, Compared to Typical Concentrations at the National Seashore Monitor**

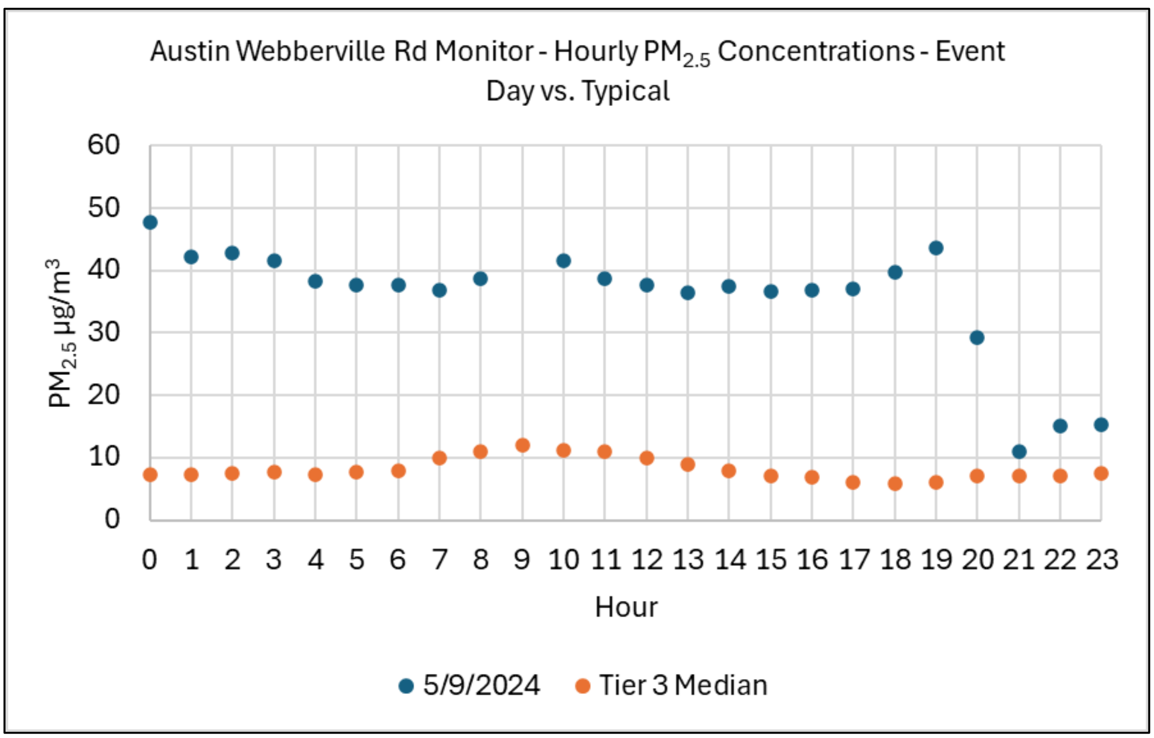


**Figure 3-62: Hourly $PM_{2.5}$ Concentrations on May 9, 2024, Compared to Typical Concentrations at the Webberville Monitor**

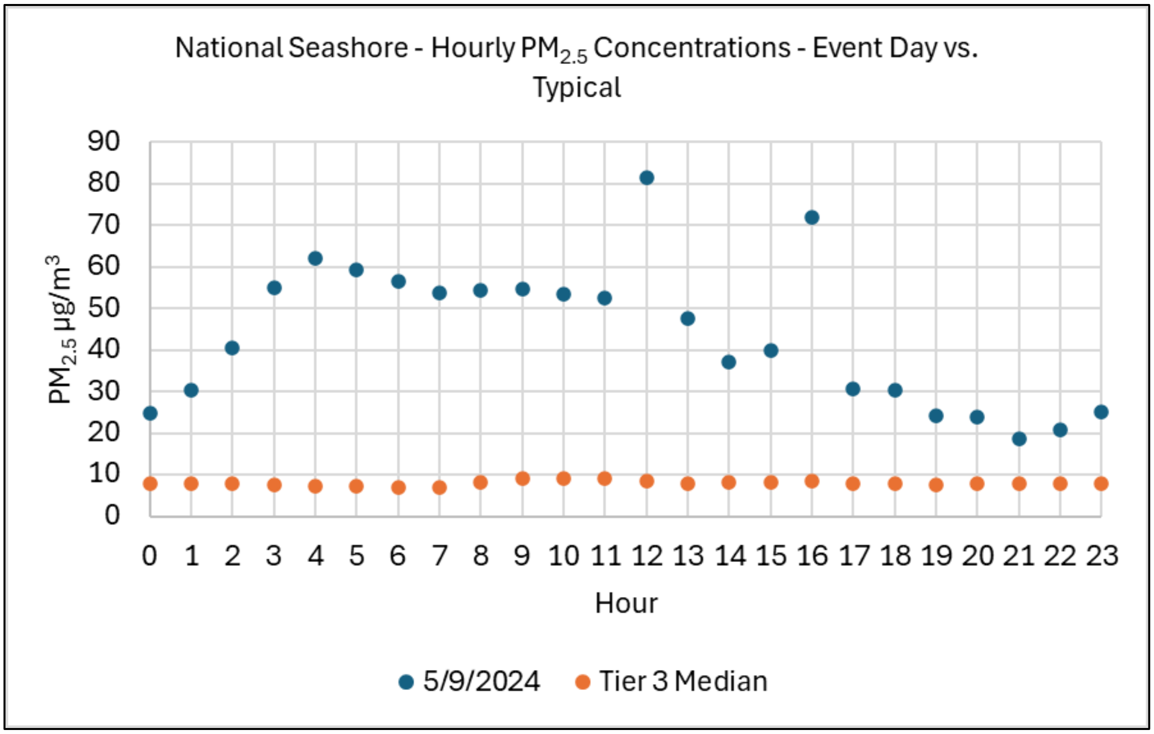


**Figure 3-63: Hourly $PM_{2.5}$ Concentrations on May 9, 2024, Compared to Typical Concentrations at the National Seashore Monitor**

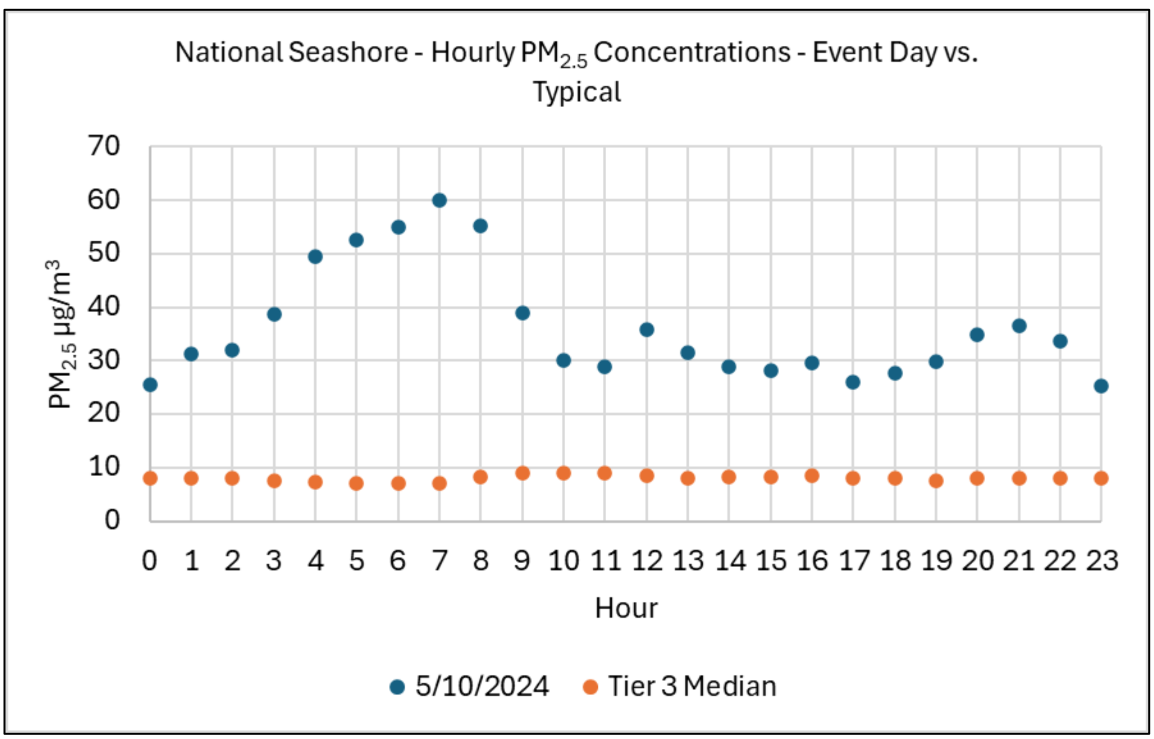


**Figure 3-64: Hourly $PM_{2.5}$ Concentrations on May 10, 2024, Compared to Typical Concentrations at the National Seashore Monitor**

The events of May 7 through May 10, 2024, appear to be caused by fires on the Yucatan Peninsula in Mexico. Figure 3-74: *AirNow HMS Smoke Plume for May 7, 2024*, Figure 3-75:

*AirNow HMS Smoke Plume for May 8, 2024*, Figure 3-76*: NOAA HMS Fire and Smoke Plume Map for May 9, 2024*, and Figure 3-77: *AirNow HMS Smoke Plume for May 10, 2024*, all show the presence of smoke plumes over the National Seashore, Webberville and North Hills monitoring sites. Figure 3-65: *AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville Monitor on May 7, 2024*, Figure 3-66: *AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville and North Hills Monitors on May 8, 2024*, Figure 3-67: *AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on May 8, 2024*, Figure 3-68: *AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on May 9, 2024*, and Figure 3-69: *AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on May 10, 2024*, show that HYSPLIT back trajectories arrive at the monitoring sites after passing over the Yucatan Peninsula and smoke plumes along the way before reaching the monitoring sites. Figure 3-70: *NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting on May 4, 2024*, Figure 3-71: *NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting on May 5, 2024*, Figure 3-72: *NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting on May 6, 2024*, and Figure 3-73: *NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting on May 7, 2024*, show that forward HYSPLIT trajectories from the Yucatan Peninsula travel through the National Seashore and both Webberville and North Hills monitoring sites on all four days.

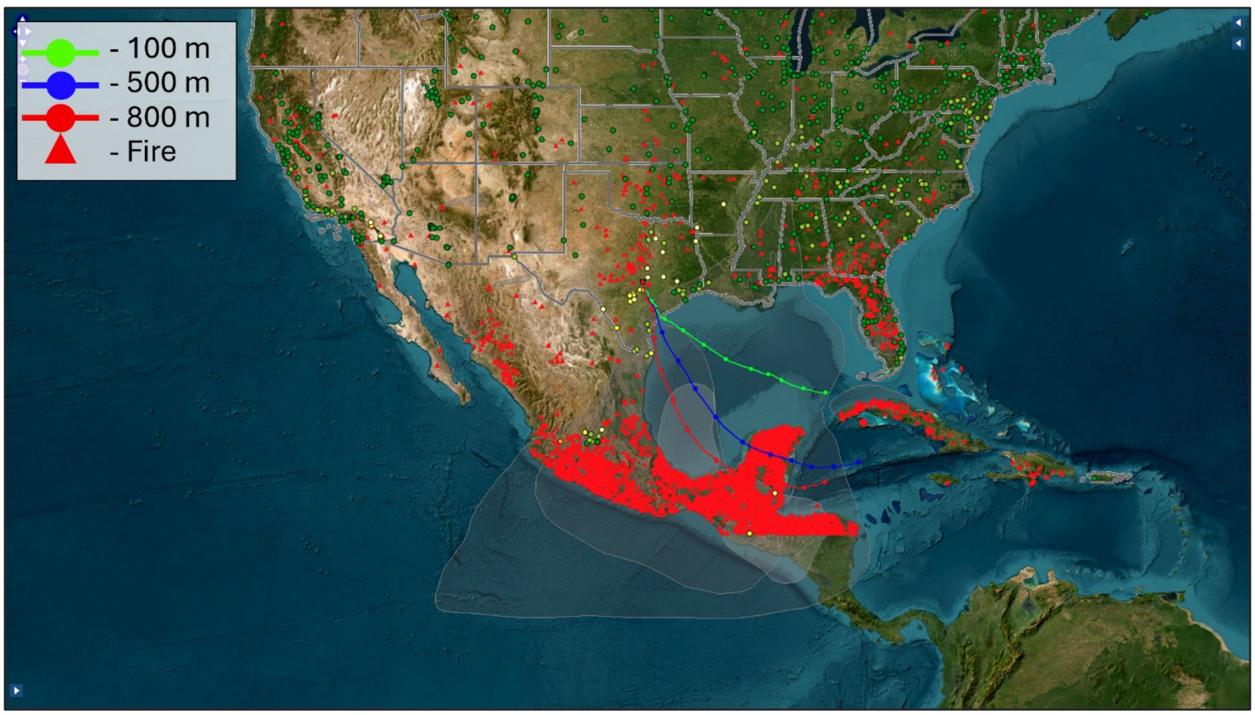


**Figure 3-65: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville Monitor on May 7, 2024**


**Figure 3-66: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville and North Hills Monitors on May 8, 2024**

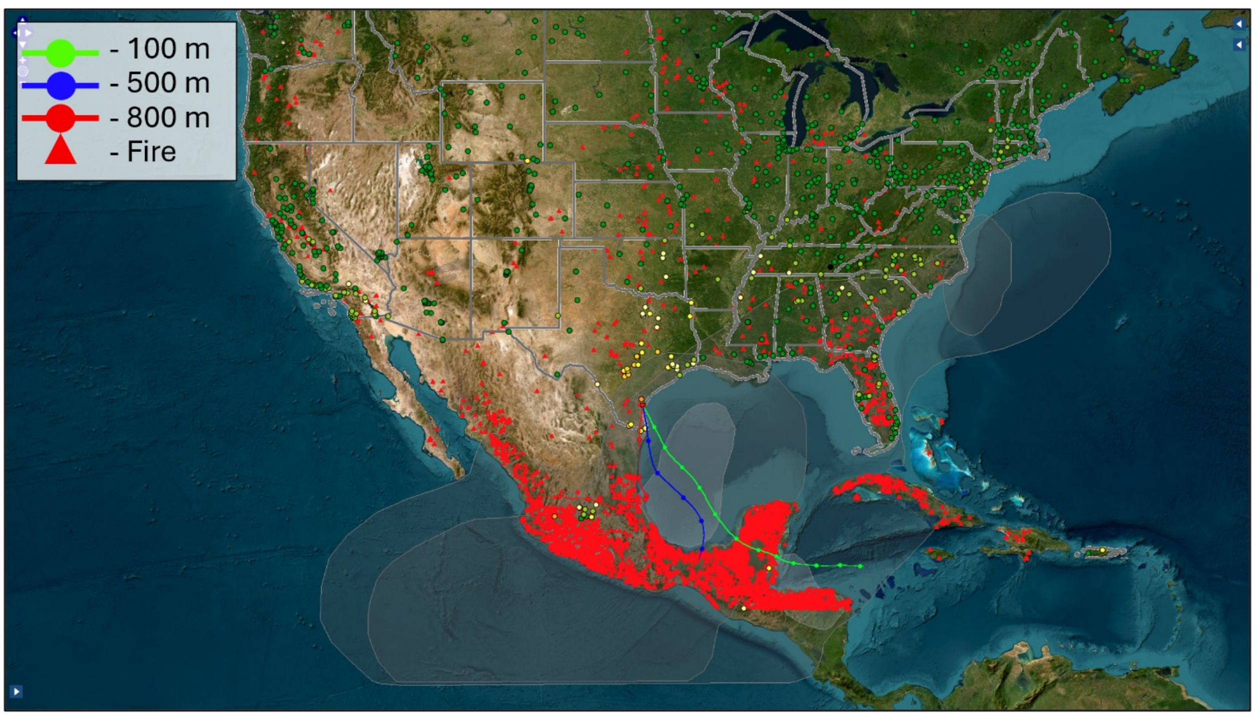


**Figure 3-67: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on May 8, 2024**

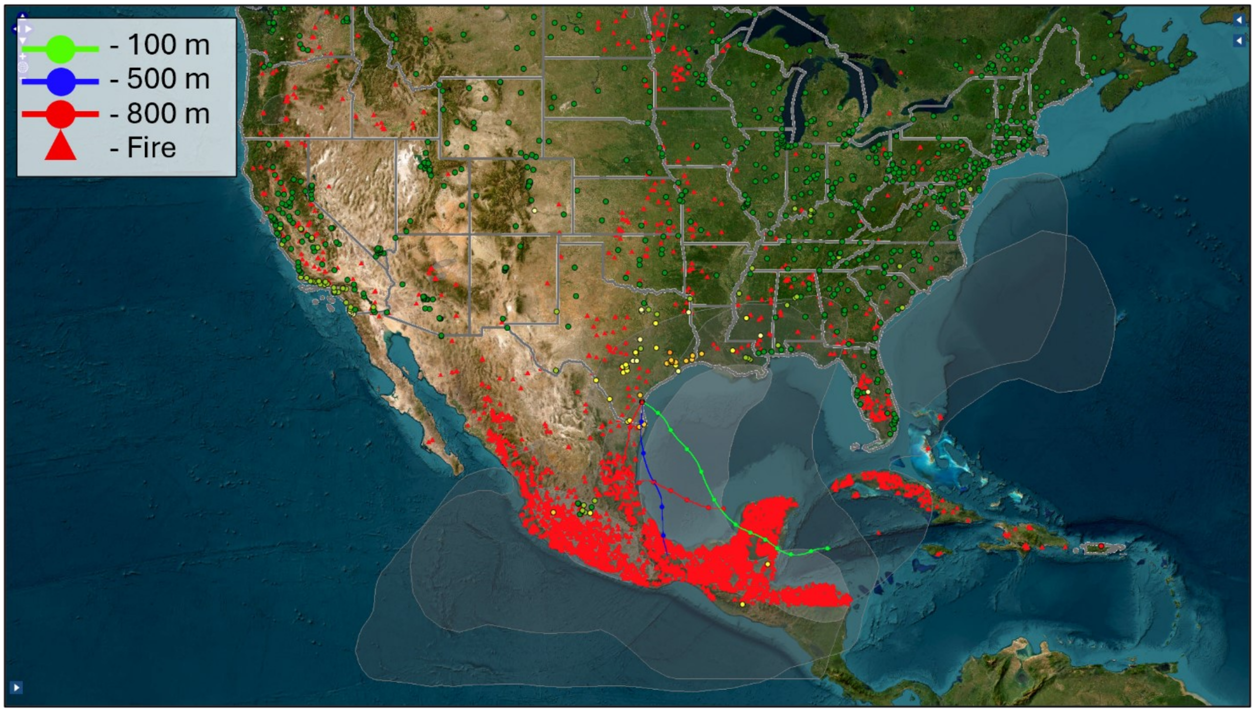

Figure 3-68: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on May 9, 2024

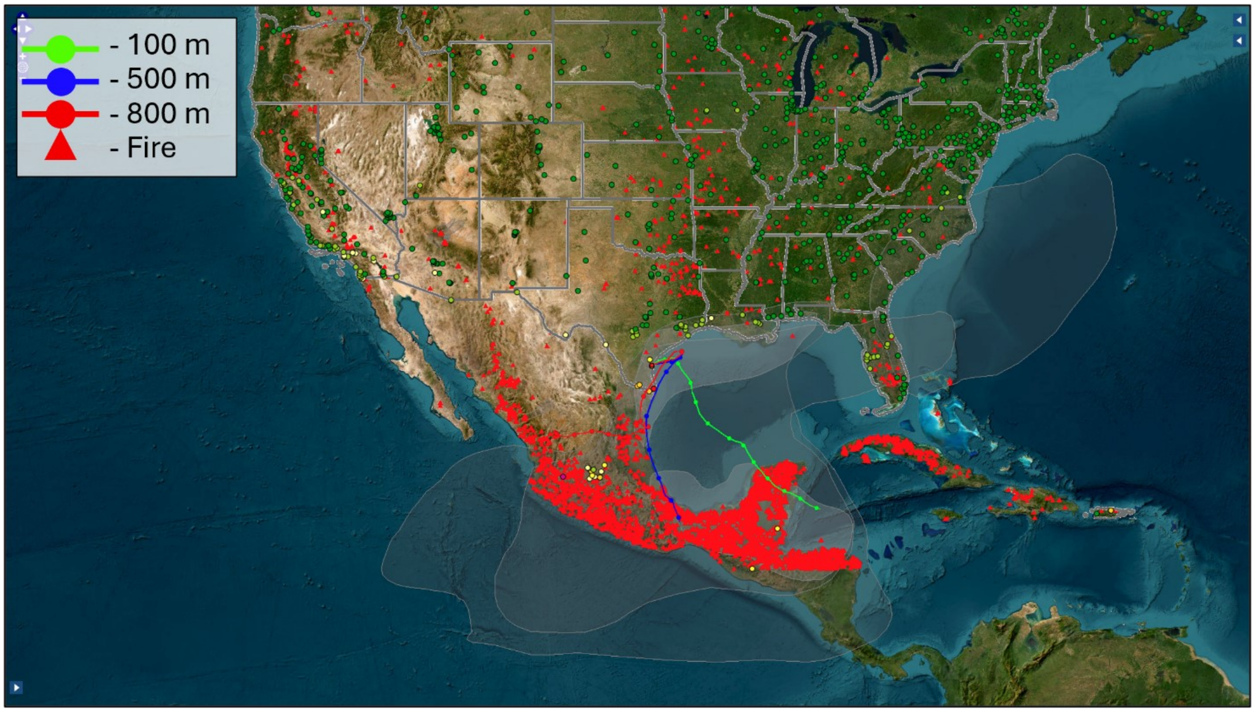

Figure 3-69: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on May 10, 2024

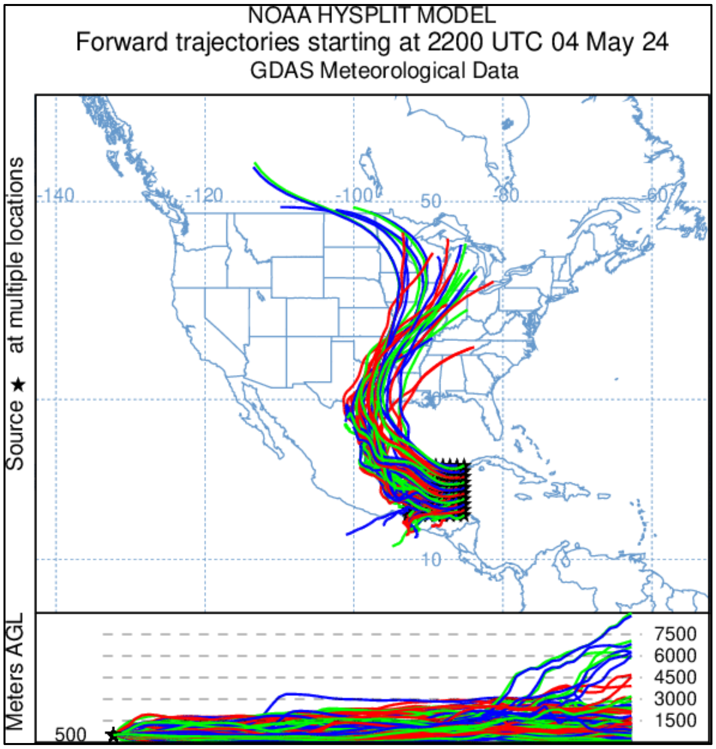


**Figure 3-70: NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting on May 4, 2024**

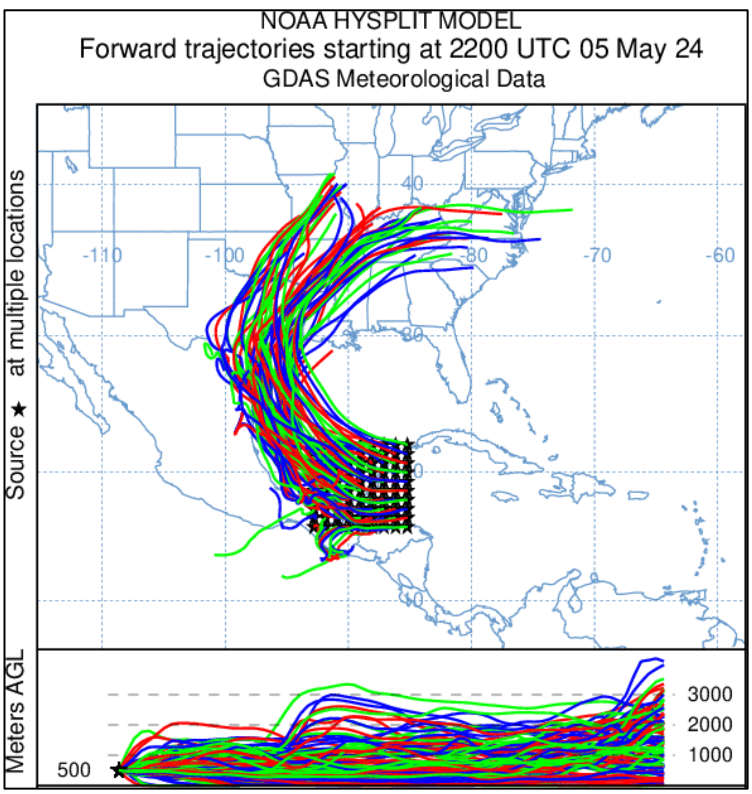


**Figure 3-71: NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting on May 5, 2024**

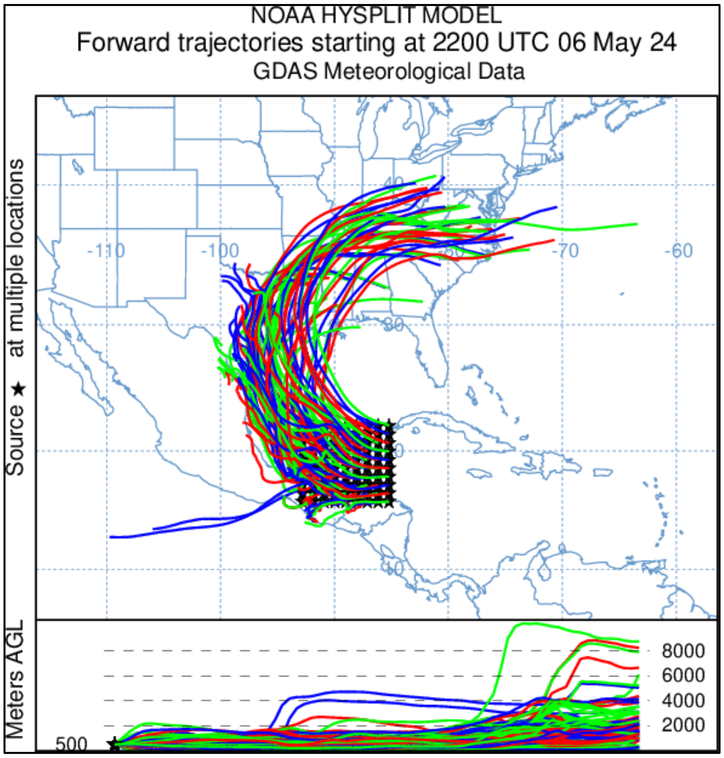


**Figure 3-72: NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting on May 6, 2024**

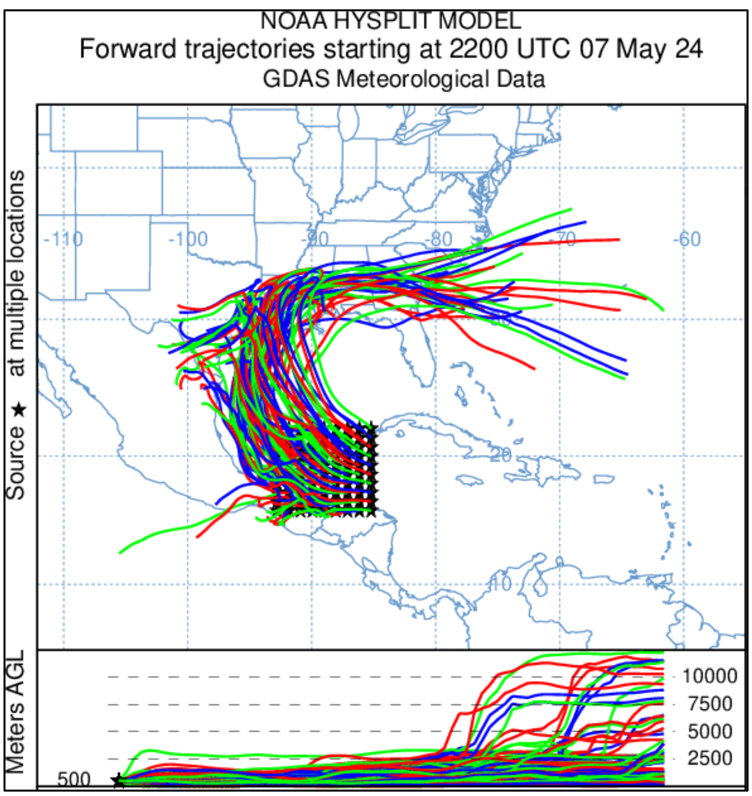


**Figure 3-73: NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting on May 7, 2024**

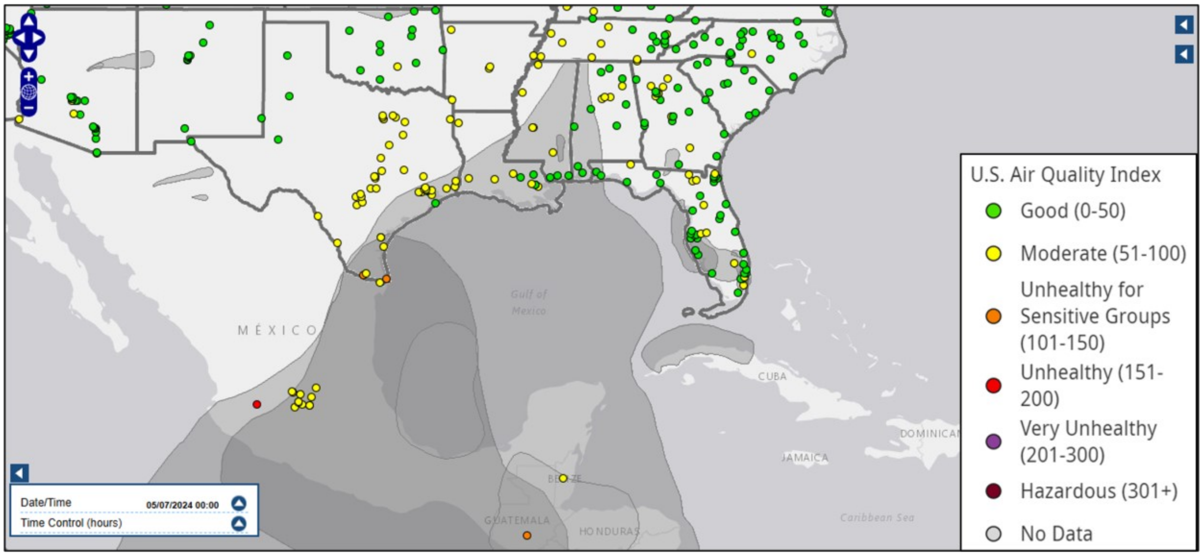


**Figure 3-74: AirNow HMS Smoke Plume for May 7, 2024**

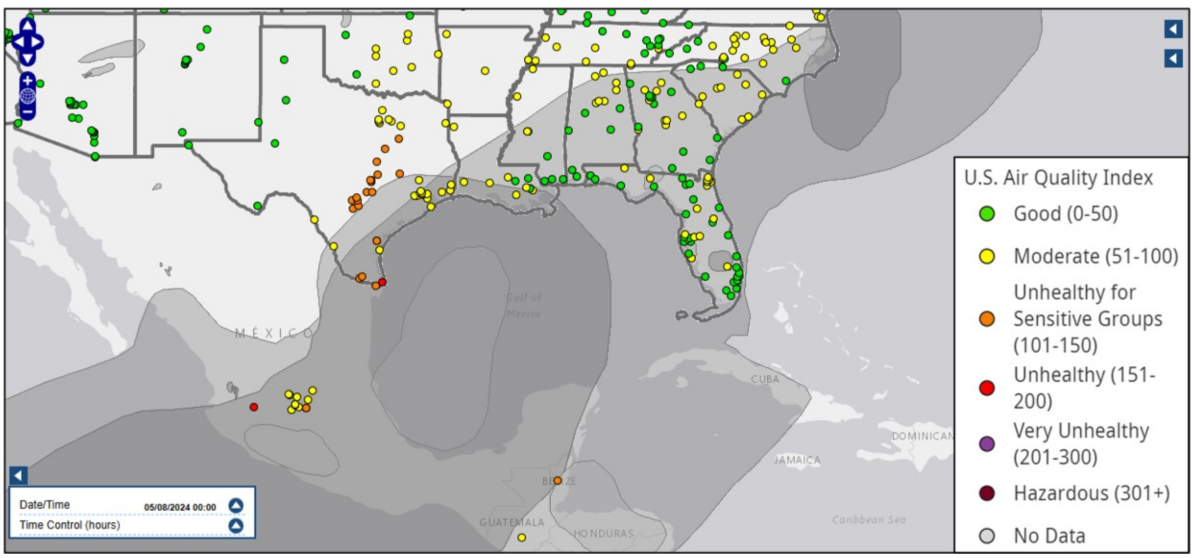


**Figure 3-75: AirNow HMS Smoke Plume for May 8, 2024**

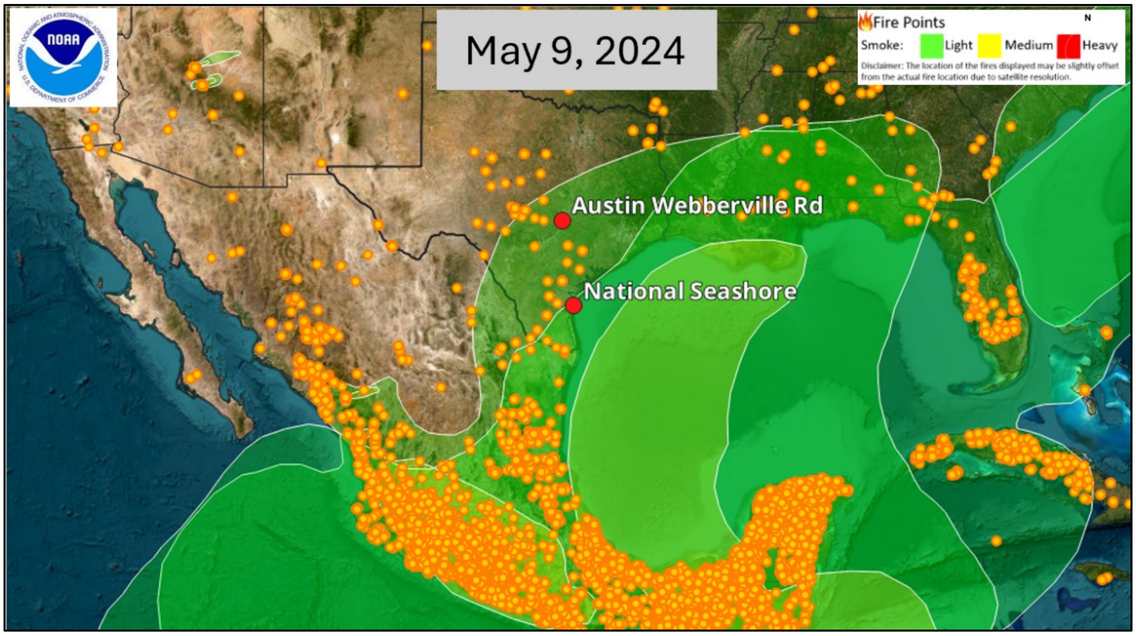


**Figure 3-76: NOAA HMS Fire and Smoke Plume Map for May 9, 2024**

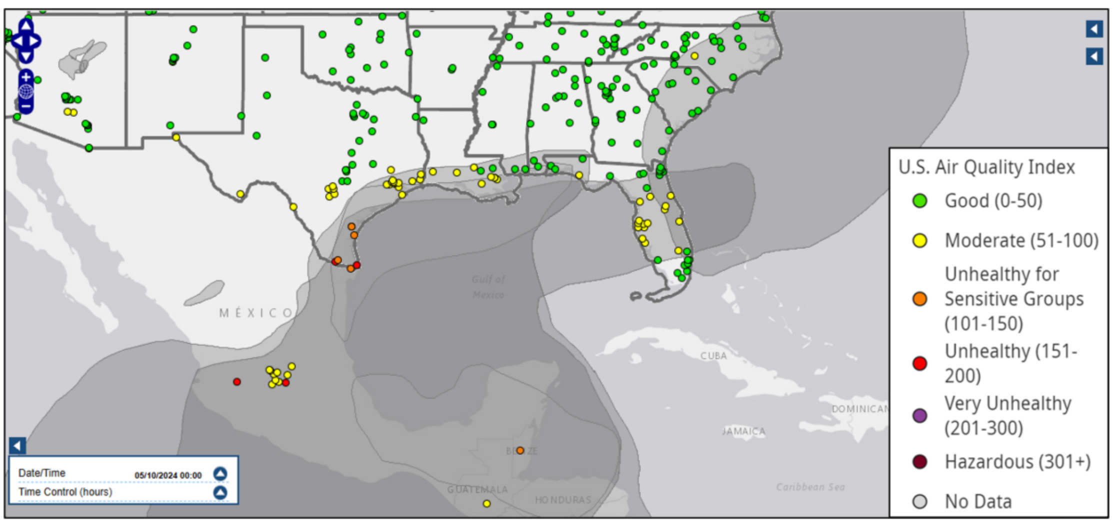


**Figure 3-77: AirNow HMS Smoke Plume for May 10, 2024**

### 3.2.11 Group 11 – Evidence for May 16, 2024, Fire (Mexico/Central America) Event for the National Seashore Monitor

On May 16, 2024, the National Seashore monitor experienced an exceptional event with a daily $PM_{2.5}$ average of 33.0 µg/m$^3$. This was a Tier 1 event at this monitor affected by smoke from fires from Mexico. Figure 3-78: *Hourly $PM_{2.5}$ Concentrations on May 16, 2024, Compared to Typical Concentrations at the National Seashore Monitor* shows how high $PM_{2.5}$ concentrations were on May 16, 2024. Figure 3-79: *AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on May 16, 2024*, shows that HYSPLIT back trajectories arrive at the monitoring sites after passing over the Yucatan Peninsula. Satellite imagery (Figure 3-81: *Aqua/MODIS Corrected Reflectance (True Color) Satellite Imagery from May 16, 2024, Showing Haze and Smoke from Mexico in the Gulf of America and Along the Texas Coast*) also shows haze and smoke being transported from Mexico into the Gulf of America and along the Texas coast.

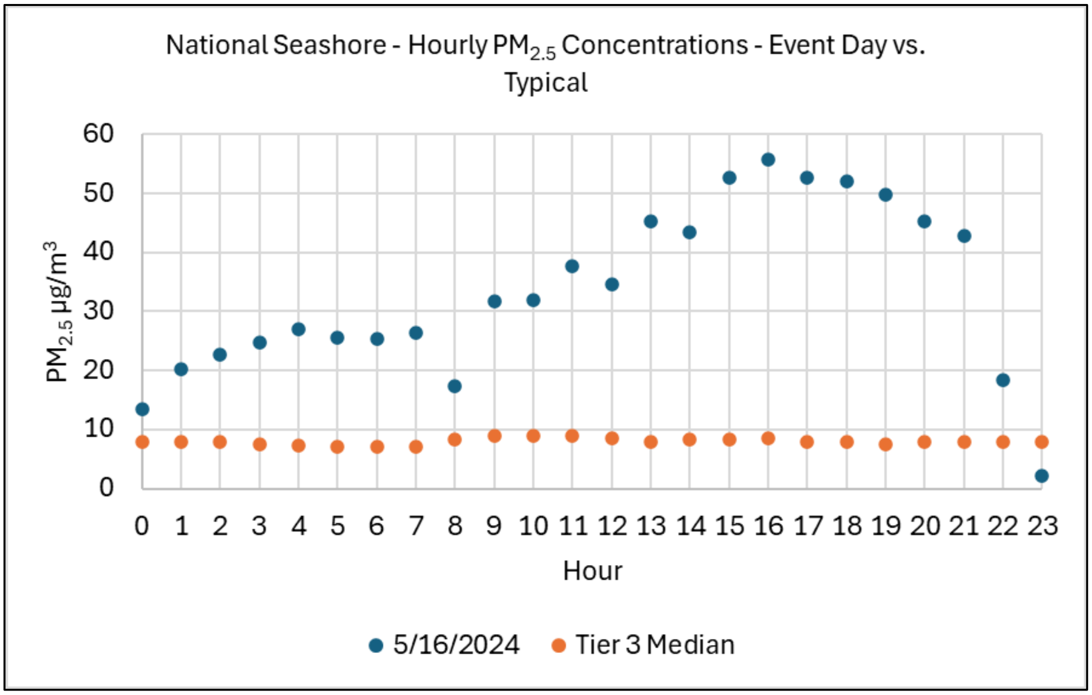


**Figure 3-78: Hourly $PM_{2.5}$ Concentrations on May 16, 2024, Compared to Typical Concentrations at the National Seashore Monitor**

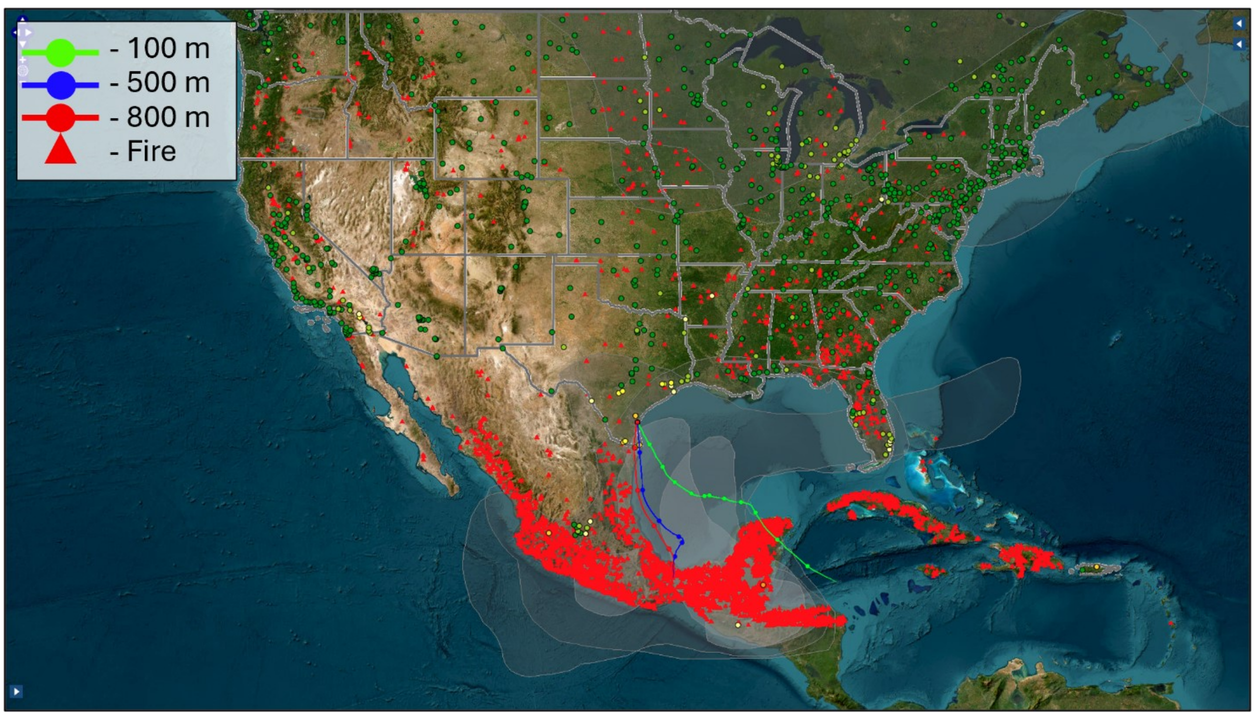


**Figure 3-79: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on May 16, 2024**

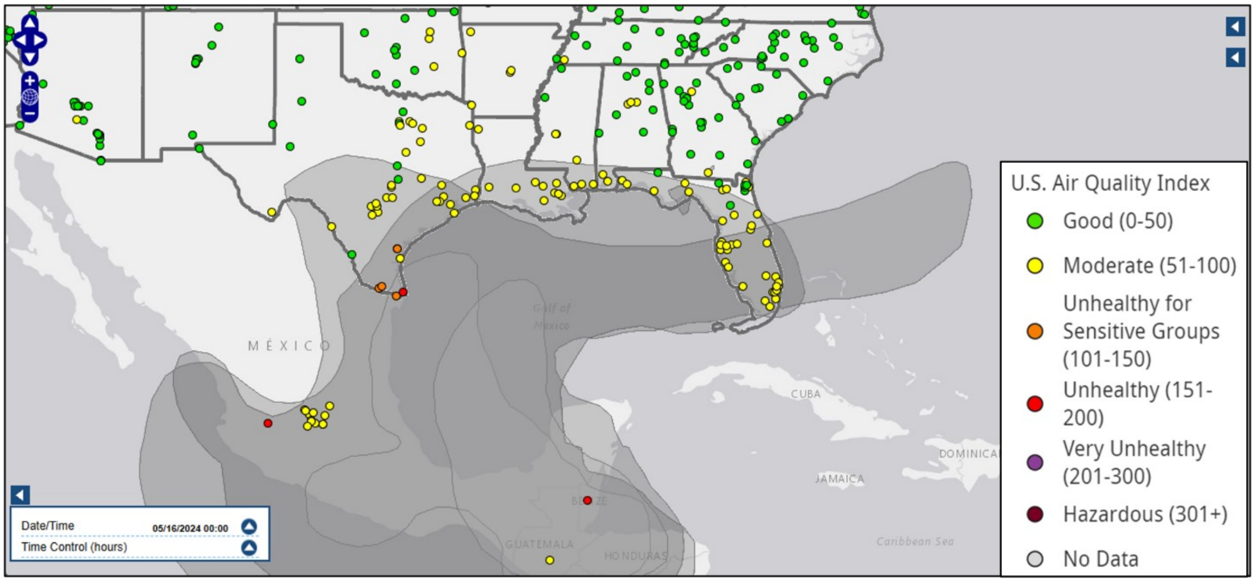


**Figure 3-80: AirNow HMS Smoke Plume for May 16, 2024**

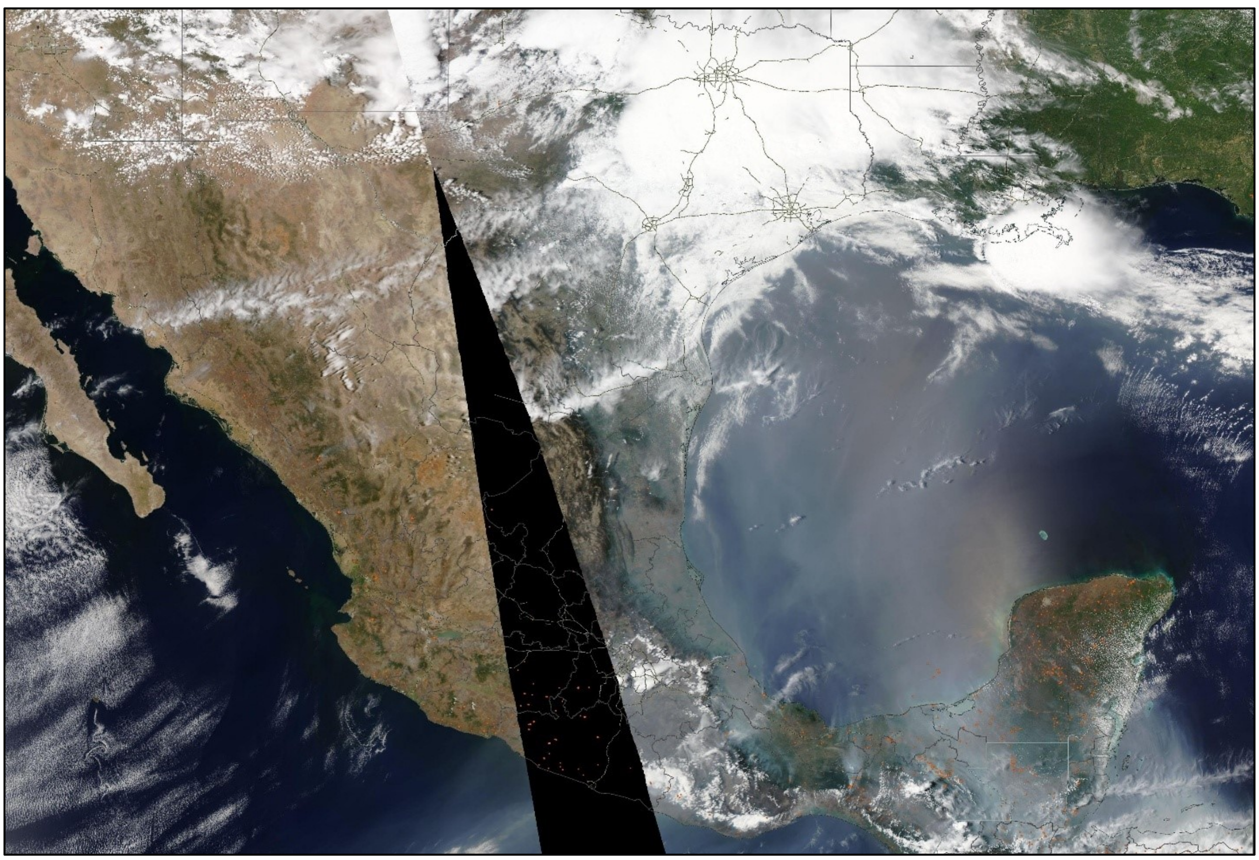

**Figure 3-81: Aqua/MODIS Corrected Reflectance (True Color) Satellite Imagery from May 16, 2024, Showing Haze and Smoke from Mexico in the Gulf of America and Along the Texas Coast**

### 3.2.12 Group 12 –Evidence for May 19 through May 28, 2024, Fire (Mexico/Central America) Events for the Webberville and National Seashore Monitors

During the period of May 19 through May 28, 2024, the Webberville and National Seashore monitors experienced many exceptional events due to wildfires in Mexico. Table 3-2: *Summary of Event Dates and Measurements for Group 12 Events*, summarizes the daily average $PM_{2.5}$ on the event days and corresponding tiers.

**Table 3-2: Summary of Event Dates and Measurements for Group 12 Events**

| Date | Monitor | Exceedance Concentration | Tier |
|---|---|---:|---:|
| 05/19/24 | National Seashore | 25.1 | 2 |
| 05/20/24 | National Seashore | 24.9 | 2 |
| 05/21/24 | Webberville | 31.3 | 1 |
| 05/21/24 | National Seashore | 31.4 | 1 |
| 05/22/24 | Webberville | 31.6 | 1 |
| 05/23/24 | Webberville | 25.2 | 2 |
| 05/23/24 | National Seashore | 28.7 | 1 |
| 05/24/24 | Webberville | 33.8 | 1 |
| 05/24/24 | National Seashore | 28.4 | 1 |
| 05/25/24 | Webberville | 32.8 | 1 |
| 05/25/24 | National Seashore | 28.4 | 1 |
| 05/26/24 | Webberville | 35.6 | 1 |
| 05/26/24 | National Seashore | 33.3 | 1 |
| 05/27/24 | Webberville | 41.7 | 1 |
| 05/27/24 | National Seashore | 38 | 1 |
| 05/28/24 | National Seashore | 25.1 | 2 |

The following figures compare hourly $PM_{2.5}$ concentrations on each event day to a typical day at both the Webberville and National Seashore monitors.

- Figure 3-82: *Hourly $PM_{2.5}$ Concentrations on May 19, 2024, Compared to Typical Concentrations at the National Seashore Monitor*
- Figure 3-83: *Hourly $PM_{2.5}$ Concentrations on May 20, 2024, Compared to Typical Concentrations at the National Seashore Monitor*
- Figure 3-84: *Hourly $PM_{2.5}$ Concentrations on May 21, 2024, Compared to Typical Concentrations at the National Seashore Monitor*
- Figure 3-85: *Hourly $PM_{2.5}$ Concentrations on May 21, 2024, Compared to Typical Concentrations at the Webberville Monitor*
- Figure 3-86: *Hourly $PM_{2.5}$ Concentrations on May 22, 2024, Compared to Typical Concentrations at the Webberville Monitor*
- Figure 3-87: *Hourly $PM_{2.5}$ Concentrations on May 23, 2024, Compared to Typical Concentrations at the National Seashore Monitor*
- Figure 3-88: *Hourly $PM_{2.5}$ Concentrations on May 23, 2024, Compared to Typical Concentrations at the Webberville Monitor*
- Figure 3-89: *Hourly $PM_{2.5}$ Concentrations on May 24, 2024, Compared to Typical Concentrations at the Webberville Monitor*

- Figure 3-90: *Hourly $PM_{2.5}$ Concentrations on May 24, 2024, Compared to Typical Concentrations at the National Seashore Monitor*
- Figure 3-91: *Hourly $PM_{2.5}$ Concentrations on May 25, 2024, Compared to Typical Concentrations at the Webberville Monitor*
- Figure 3-92: *Hourly $PM_{2.5}$ Concentrations on May 25, 2024, Compared to Typical Concentrations at the National Seashore Monitor*
- Figure 3-93: *Hourly $PM_{2.5}$ Concentrations on May 26, 2024, Compared to Typical Concentrations at the Webberville Monitor*
- Figure 3-94: *Hourly $PM_{2.5}$ Concentrations on May 26, 2024, Compared to Typical Concentrations at the National Seashore Monitor*
- Figure 3-95: *Hourly $PM_{2.5}$ Concentrations on May27, 2024, Compared to Typical Concentrations at the Webberville Monitor*

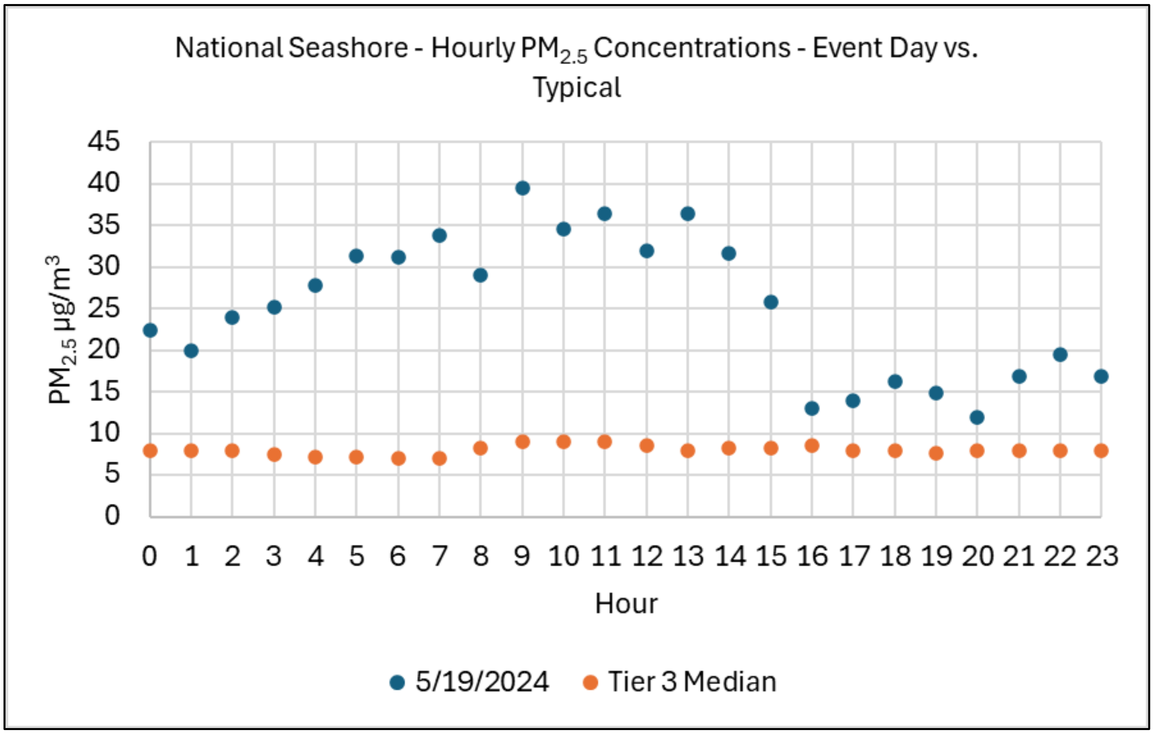


**Figure 3-82: Hourly $PM_{2.5}$ Concentrations on May 19, 2024, Compared to Typical Concentrations at the National Seashore Monitor**

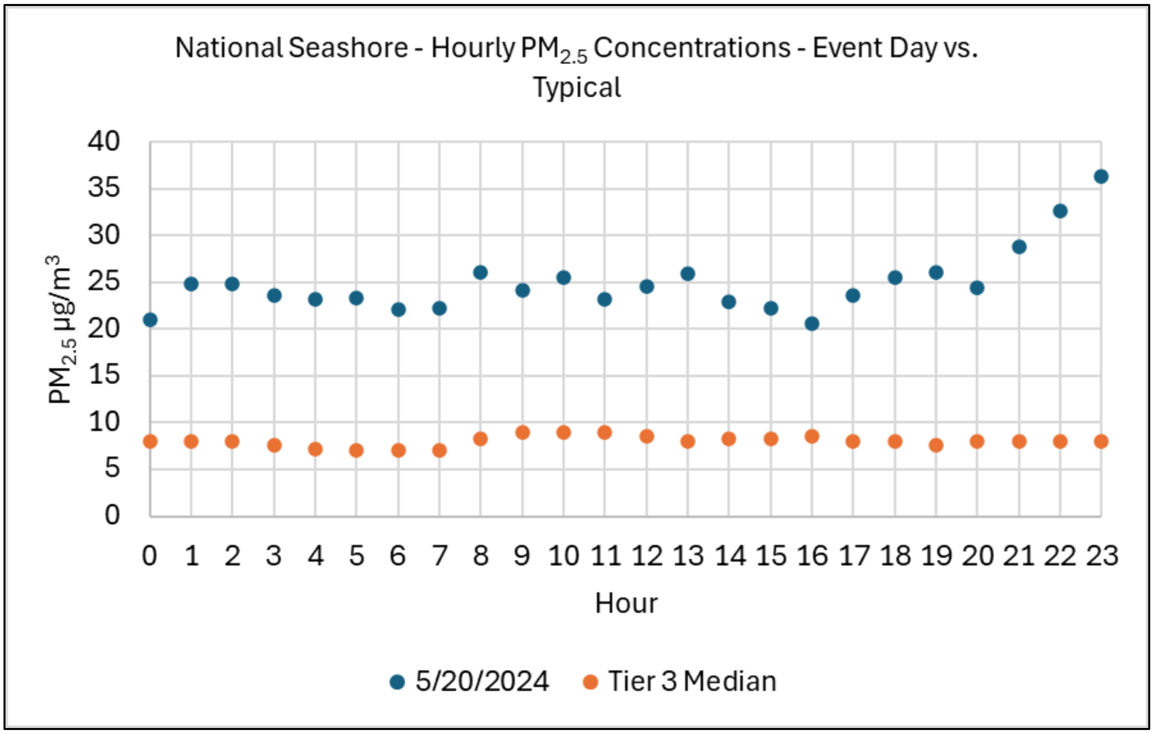


**Figure 3-83: Hourly $PM_{2.5}$ Concentrations on May 20, 2024, Compared to Typical Concentrations at the National Seashore Monitor**

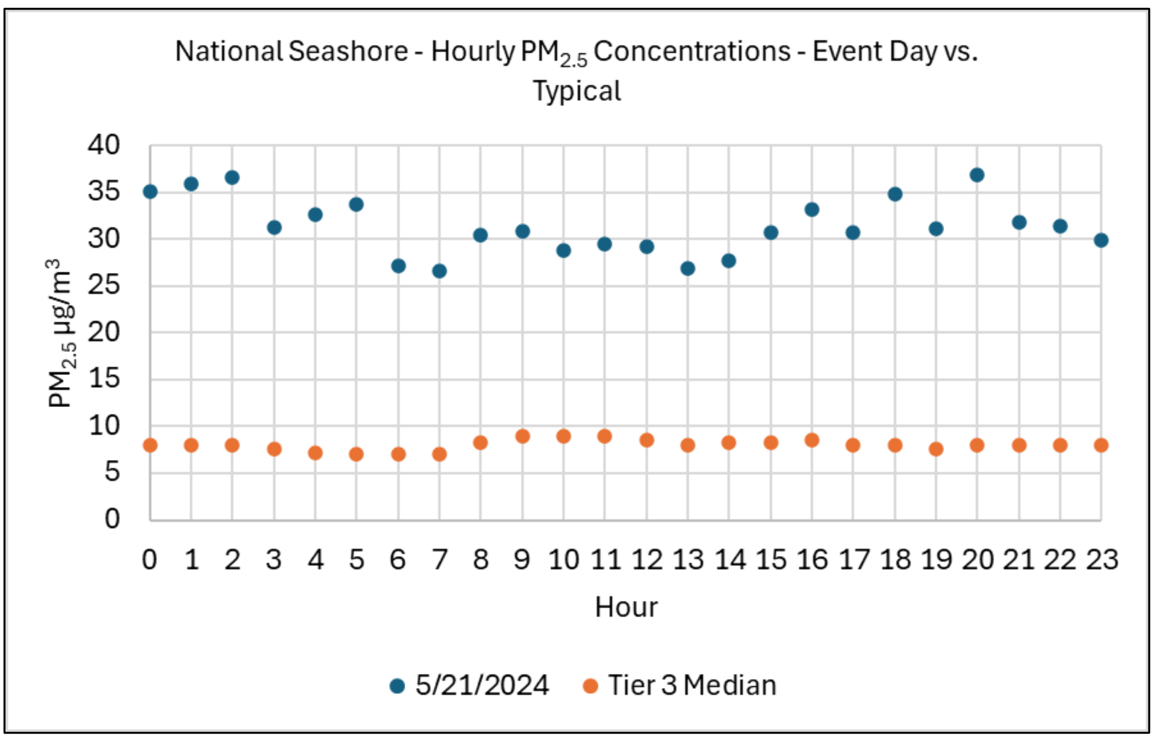


**Figure 3-84: Hourly $PM_{2.5}$ Concentrations on May 21, 2024, Compared to Typical Concentrations at the National Seashore Monitor**

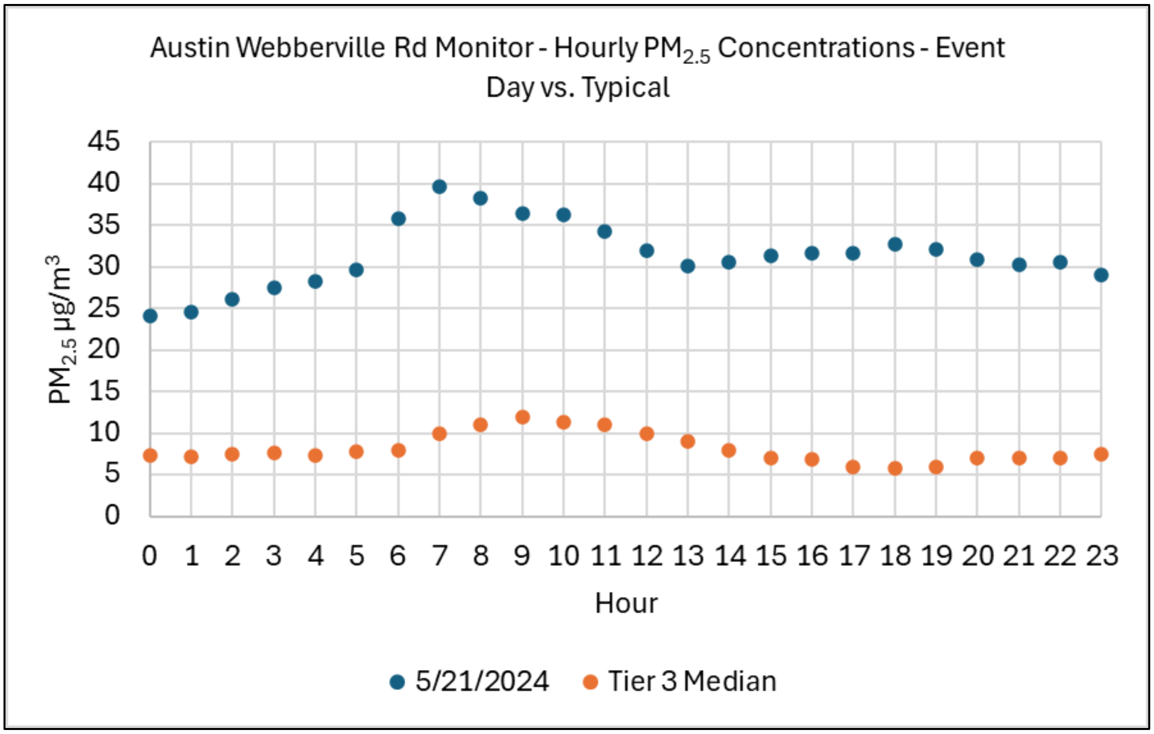


**Figure 3-85: Hourly $PM_{2.5}$ Concentrations on May 21, 2024, Compared to Typical Concentrations at the Webberville Monitor**

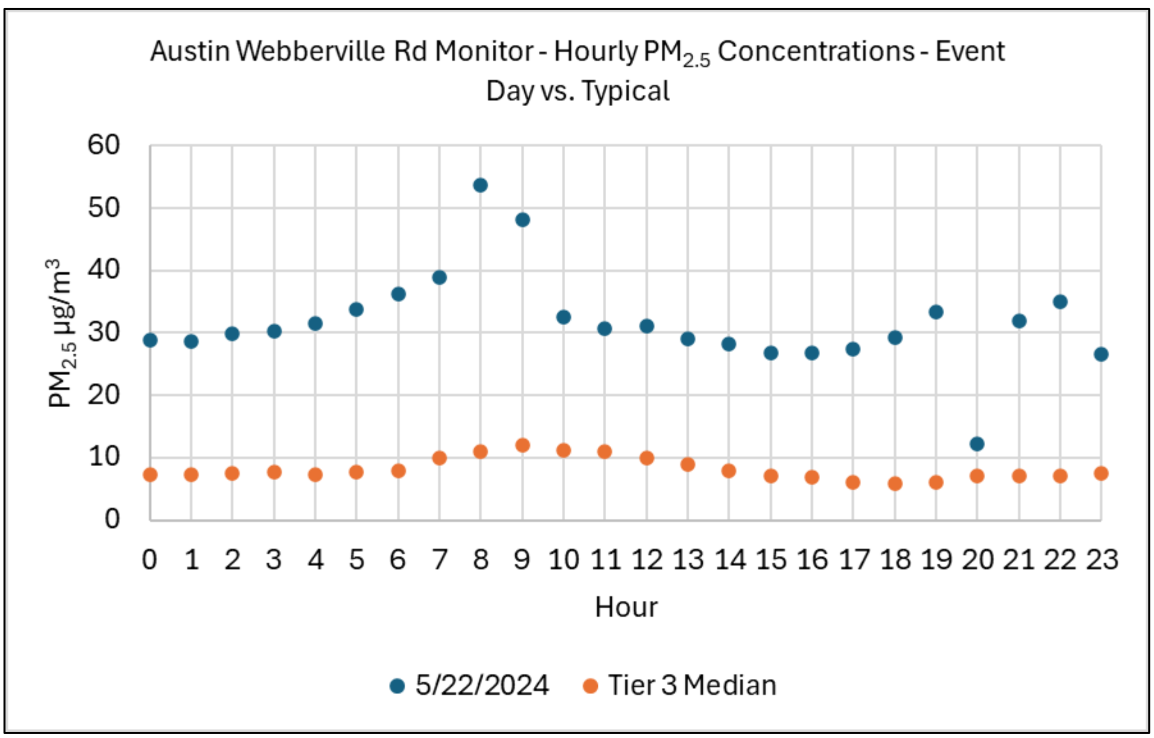


**Figure 3-86: Hourly $PM_{2.5}$ Concentrations on May 22, 2024, Compared to Typical Concentrations at the Webberville Monitor**

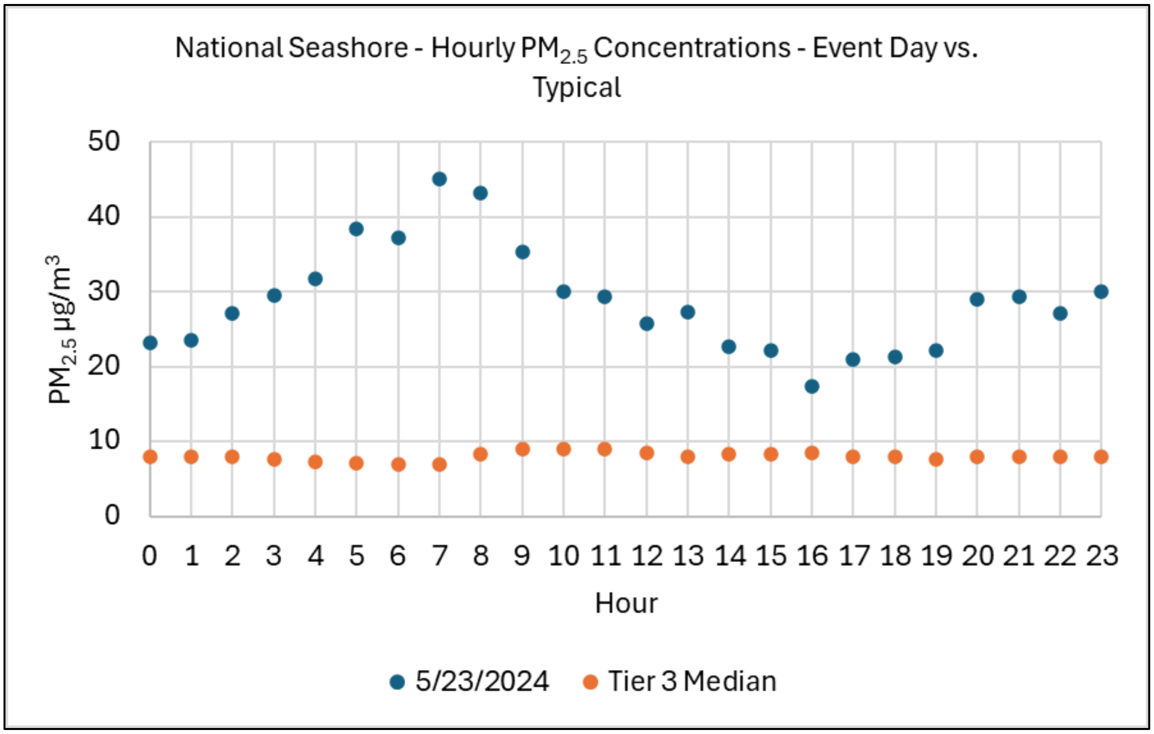


**Figure 3-87: Hourly $PM_{2.5}$ Concentrations on May 23, 2024, Compared to Typical Concentrations at the National Seashore Monitor**

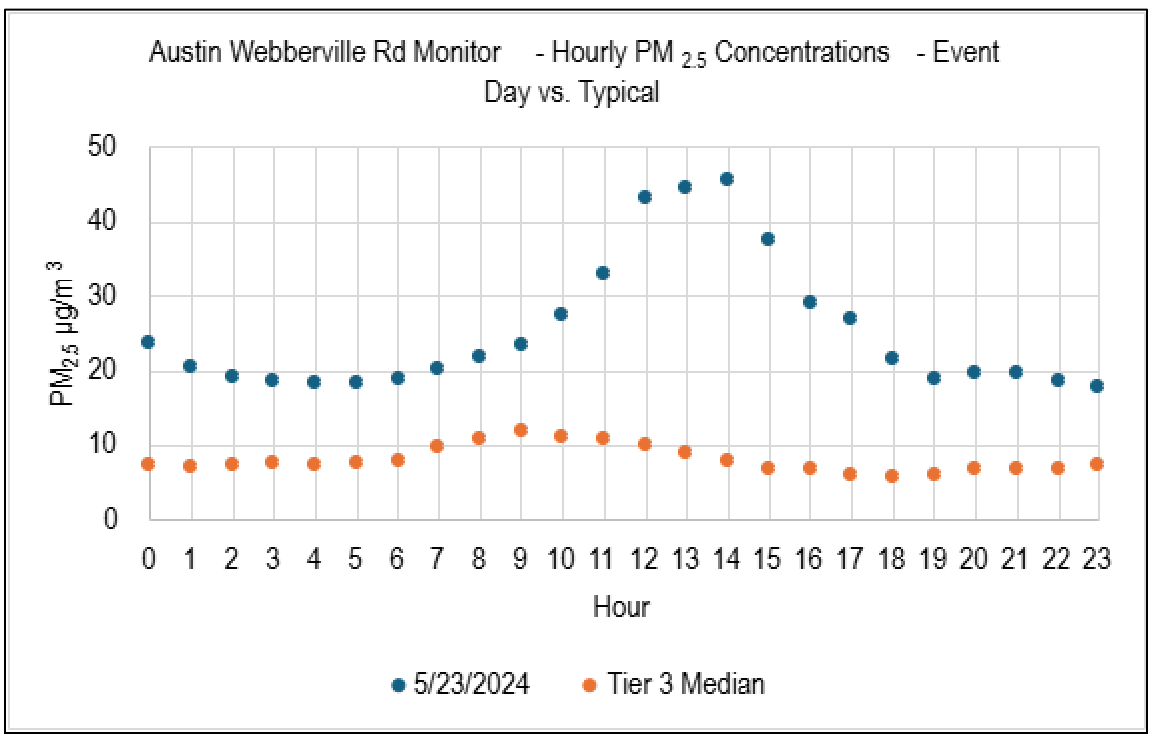


**Figure 3-88: Hourly $PM_{2.5}$ Concentrations on May 23, 2024, Compared to Typical Concentrations at the Webberville Monitor**

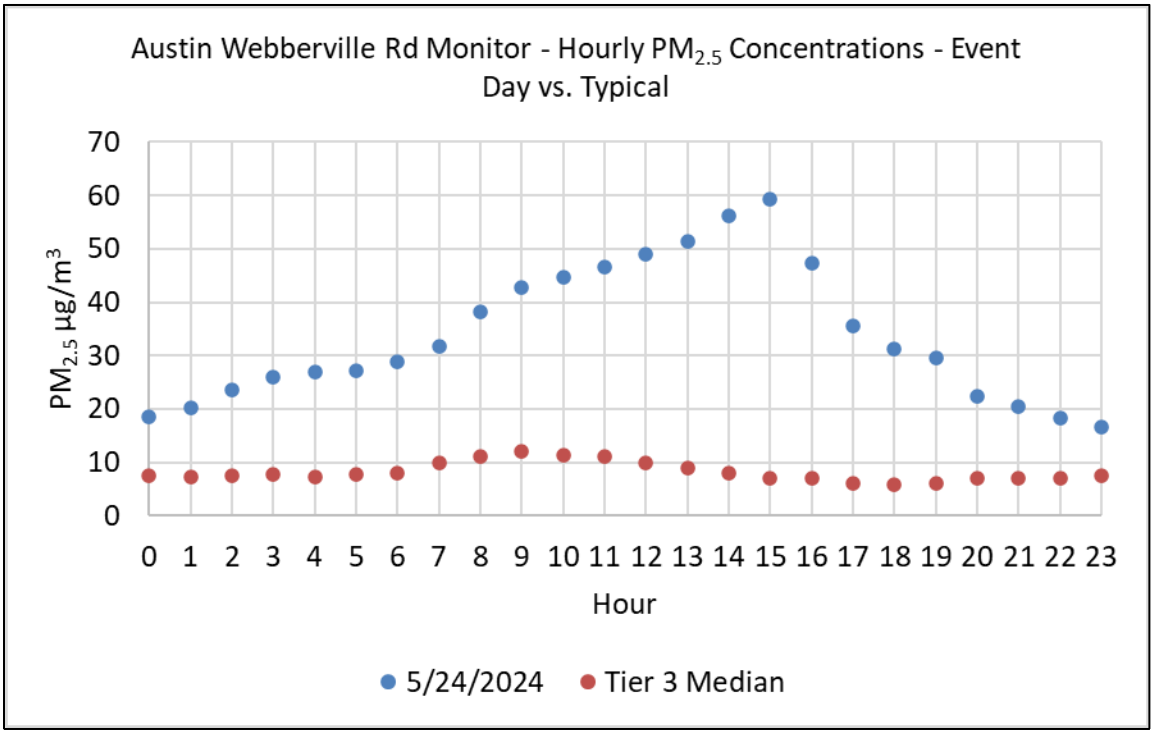


**Figure 3-89: Hourly $PM_{2.5}$ Concentrations on May 24, 2024, Compared to Typical Concentrations at the Webberville Monitor**

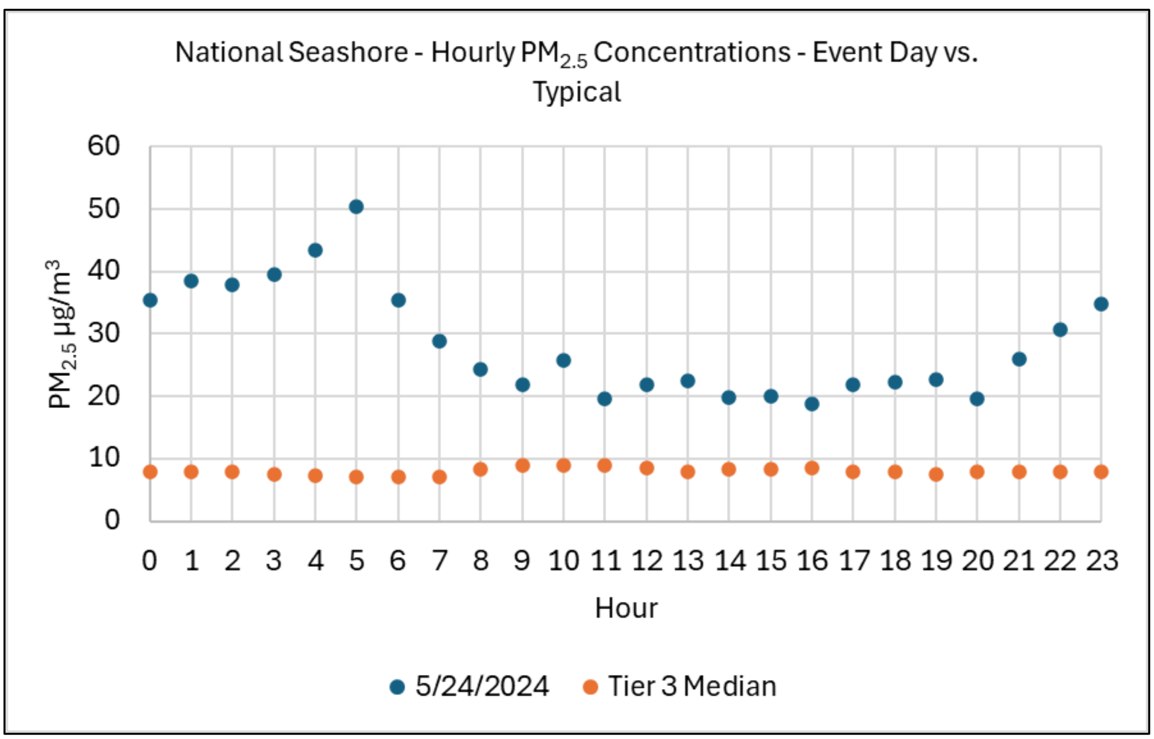


**Figure 3-90: Hourly $PM_{2.5}$ Concentrations on May 24, 2024, Compared to Typical Concentrations at the National Seashore Monitor**

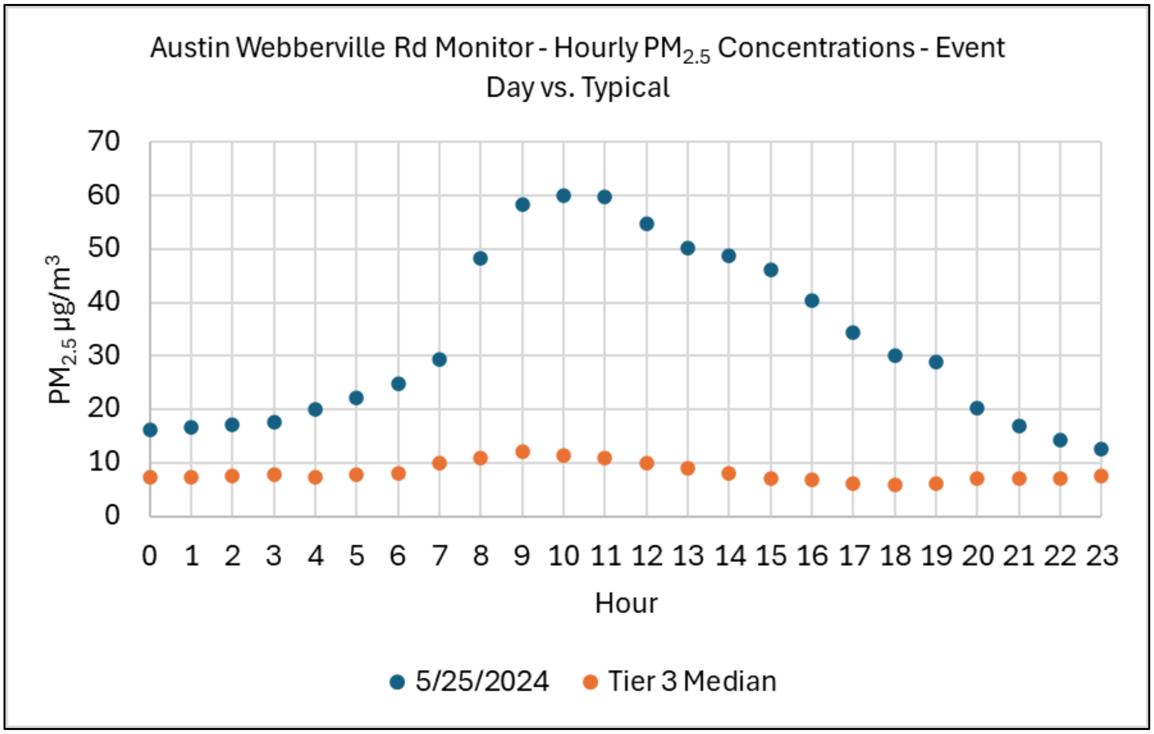


**Figure 3-91: Hourly $PM_{2.5}$ Concentrations on May 25, 2024, Compared to Typical Concentrations at the Webberville Monitor**

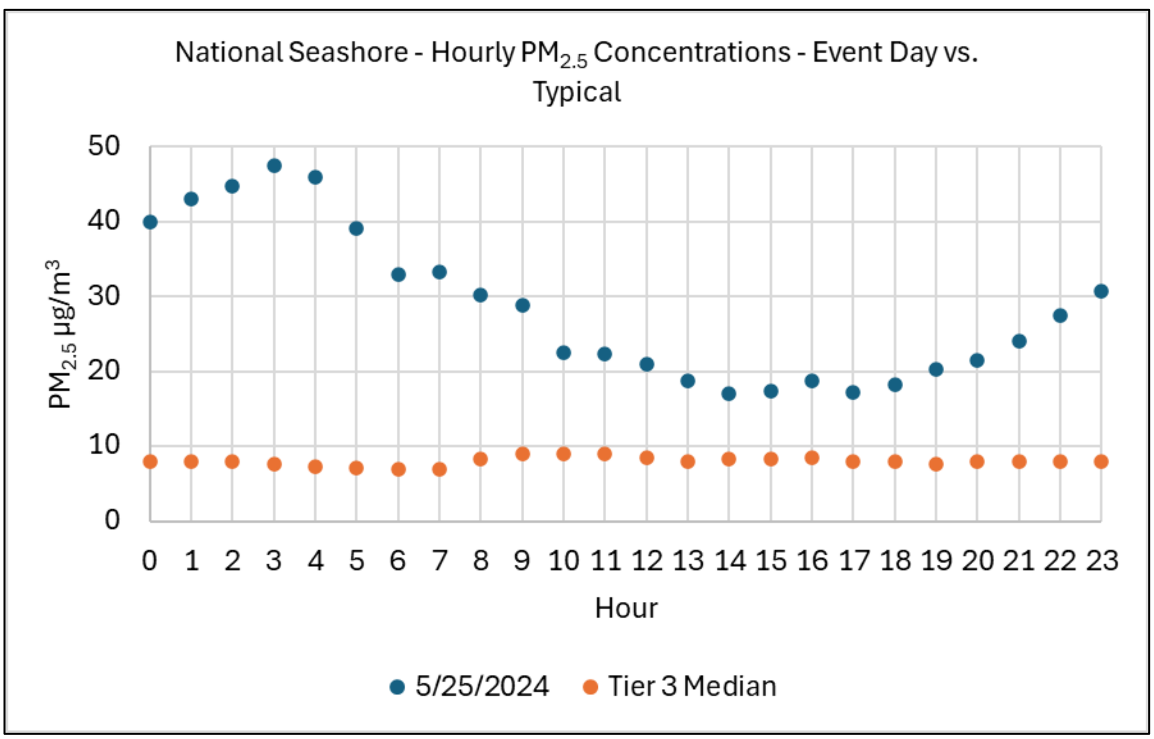


**Figure 3-92: Hourly $PM_{2.5}$ Concentrations on May 25, 2024, Compared to Typical Concentrations at the National Seashore Monitor**

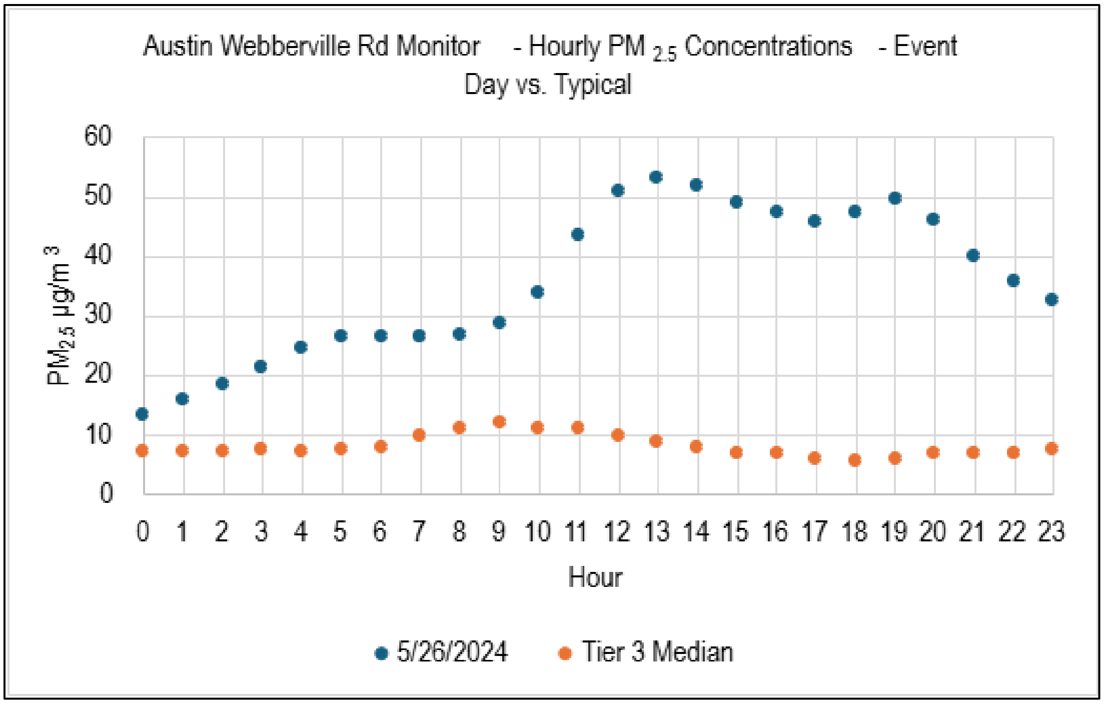


**Figure 3-93: Hourly $PM_{2.5}$ Concentrations on May 26, 2024, Compared to Typical Concentrations at the Webberville Monitor**

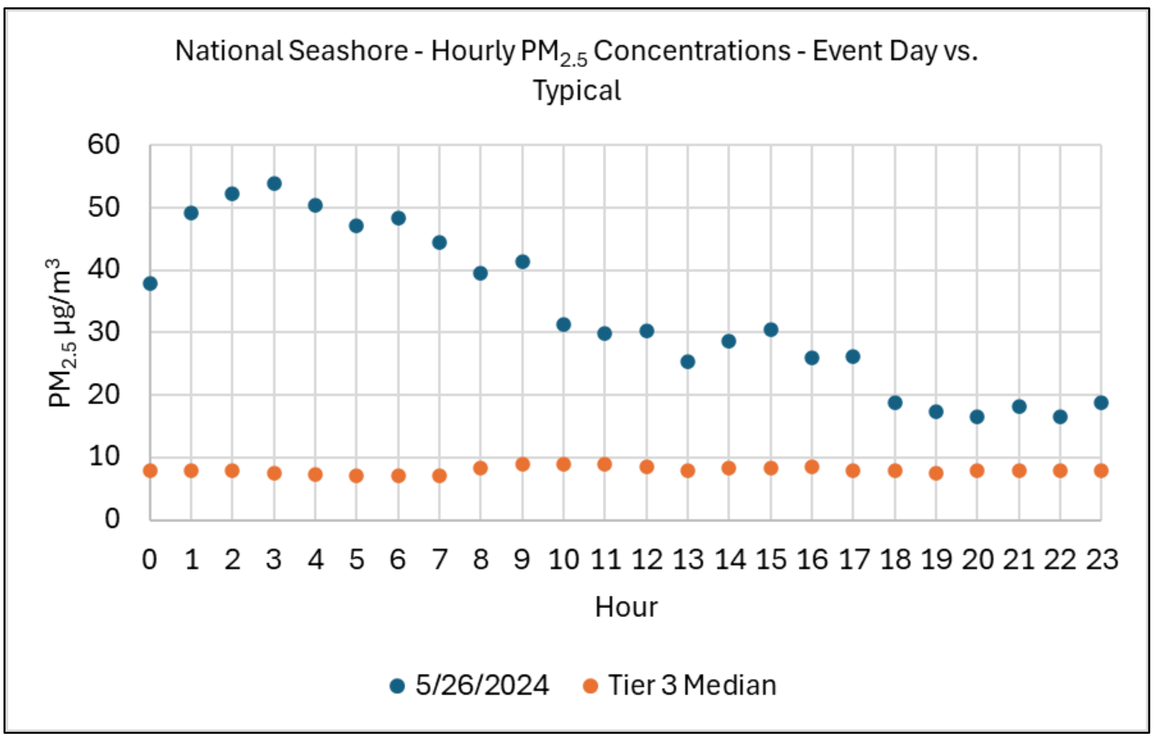


**Figure 3-94: Hourly $PM_{2.5}$ Concentrations on May 26, 2024, Compared to Typical Concentrations at the National Seashore Monitor**

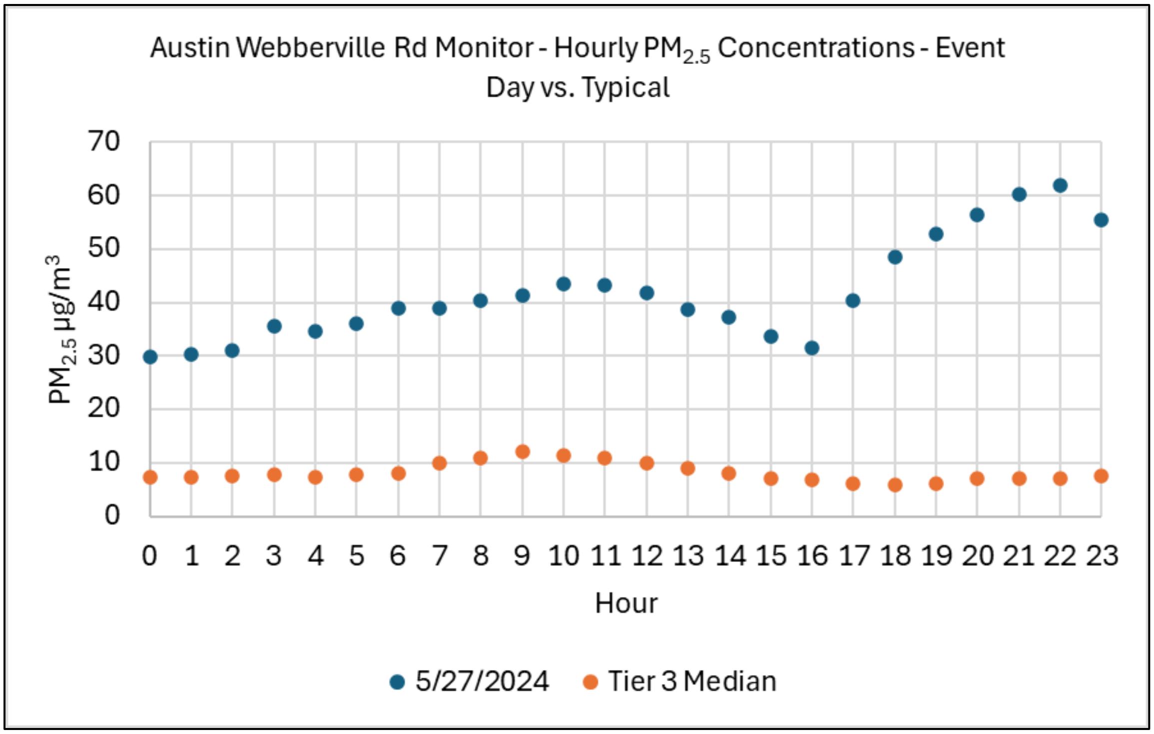


**Figure 3-95: Hourly $PM_{2.5}$ Concentrations on May27, 2024, Compared to Typical Concentrations at the Webberville Monitor**

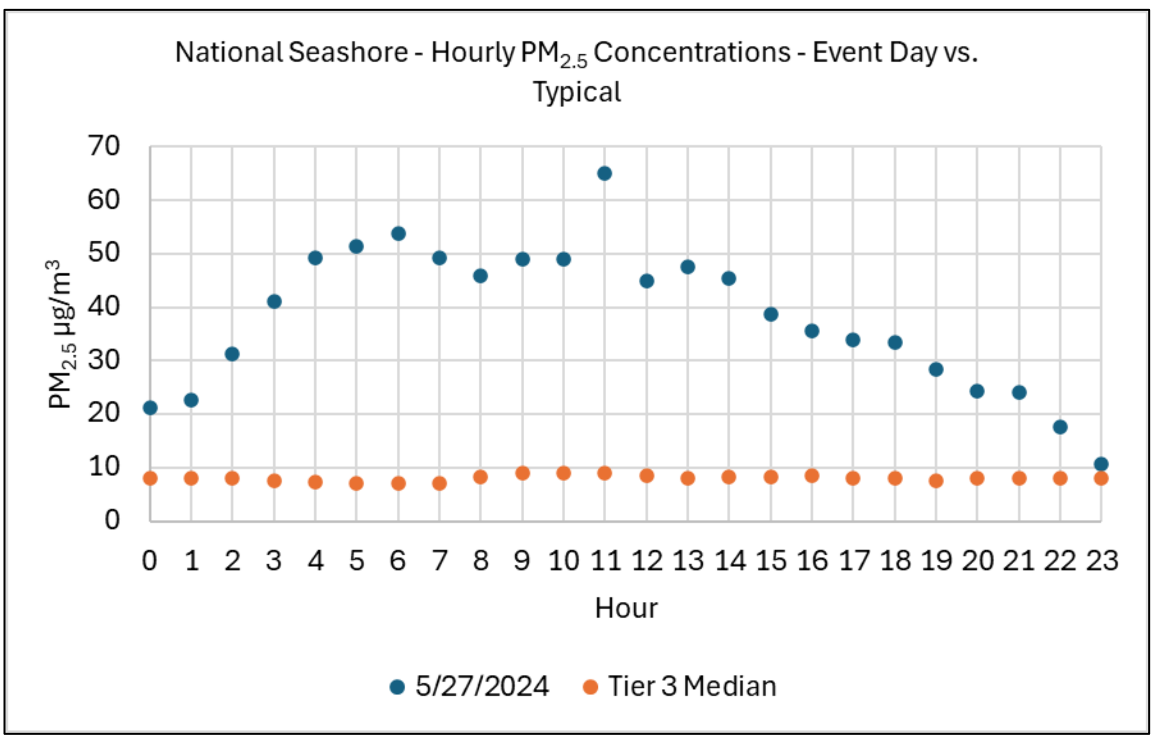


**Figure 3-96: National Seashore Hourly $PM_{2.5}$ Concentrations on May 27, 2024, Compared to Typical Concentrations at the National Seashore Monitor**

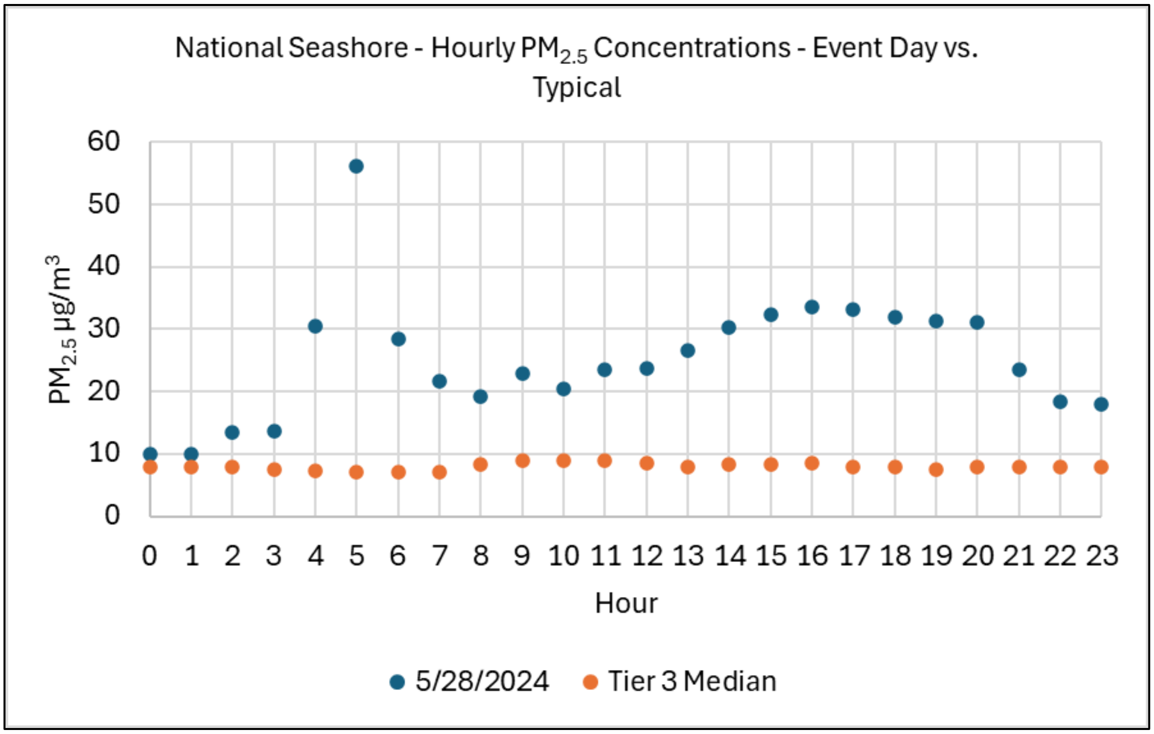


**Figure 3-97: Hourly $PM_{2.5}$ Concentrations on May 28, 2024, Compared to Typical Concentrations at the National Seashore Monitor**

The following backward trajectories generated using EPA's AirNow website, show air parcels traveling over fire locations and smoke plumes from the Yucatan Peninsula to southern and central Texas and the Webberville and National Seashore monitoring sites:

- Figure 3-98: *AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on May 19, 2024*
- Figure 3-99: *AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on May 20, 2024*
- Figure 3-100: *AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on May 21, 2024*
- Figure 3-101: *AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville Monitor on May 21, 2024*
- Figure 3-102: *AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville Monitor on May 22, 2024*
- Figure 3-103: *AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on May23, 2024*
- Figure 3-104: *AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville Monitor on May 23, 2024*
- Figure 3-105: *AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on May 24, 2024*
- Figure 3-106: *AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville Monitor on May 24, 2024*
- Figure 3-107: *AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on May 25, 2024*
- Figure 3-108: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on May 25, 2024
- Figure 3-109: *AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on May 26, 2024*

- Figure 3-110: *AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville Monitor on May 26, 2024*
- Figure 3-111: *AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on May 27, 2024*
- Figure 3-112: *AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville Monitor on May 27, 2024*
- Figure 3-113: *AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on May 28, 2024*

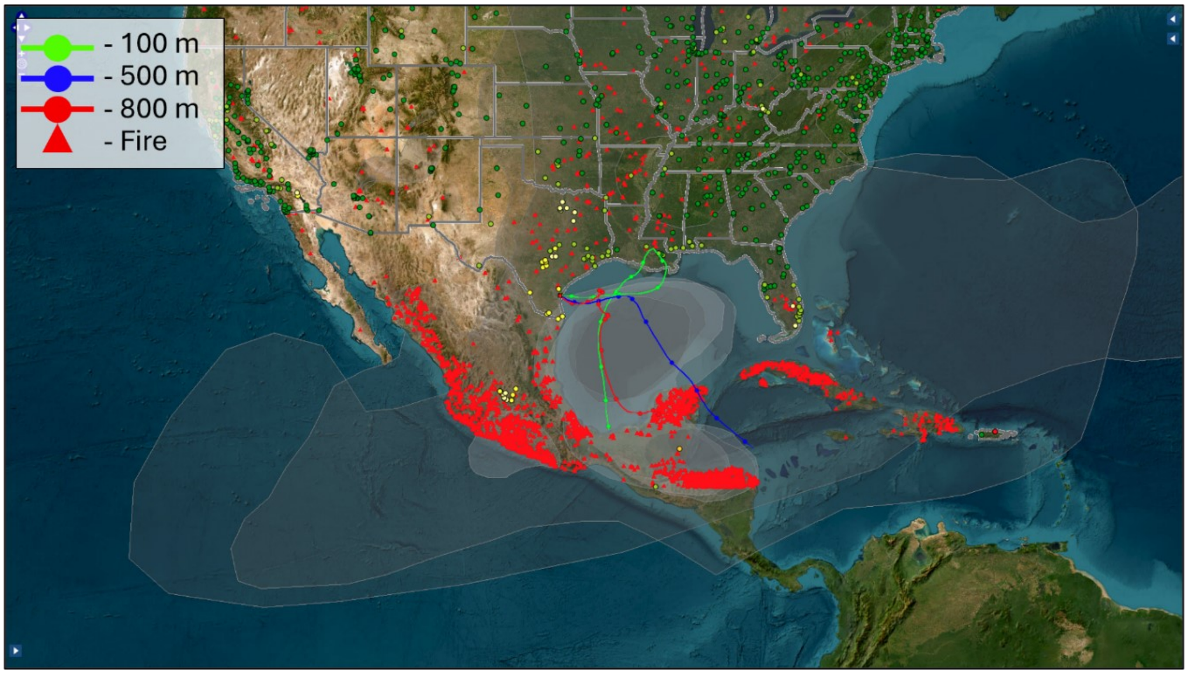


**Figure 3-98: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on May 19, 2024**

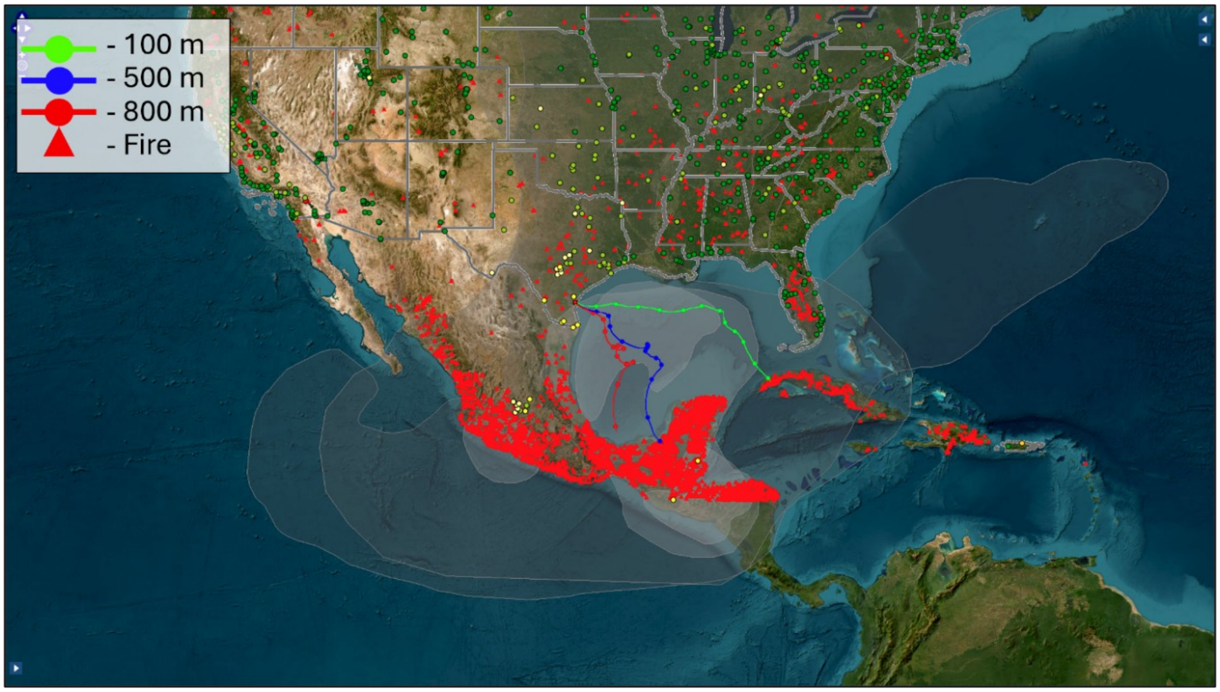


**Figure 3-99: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on May 20, 2024**

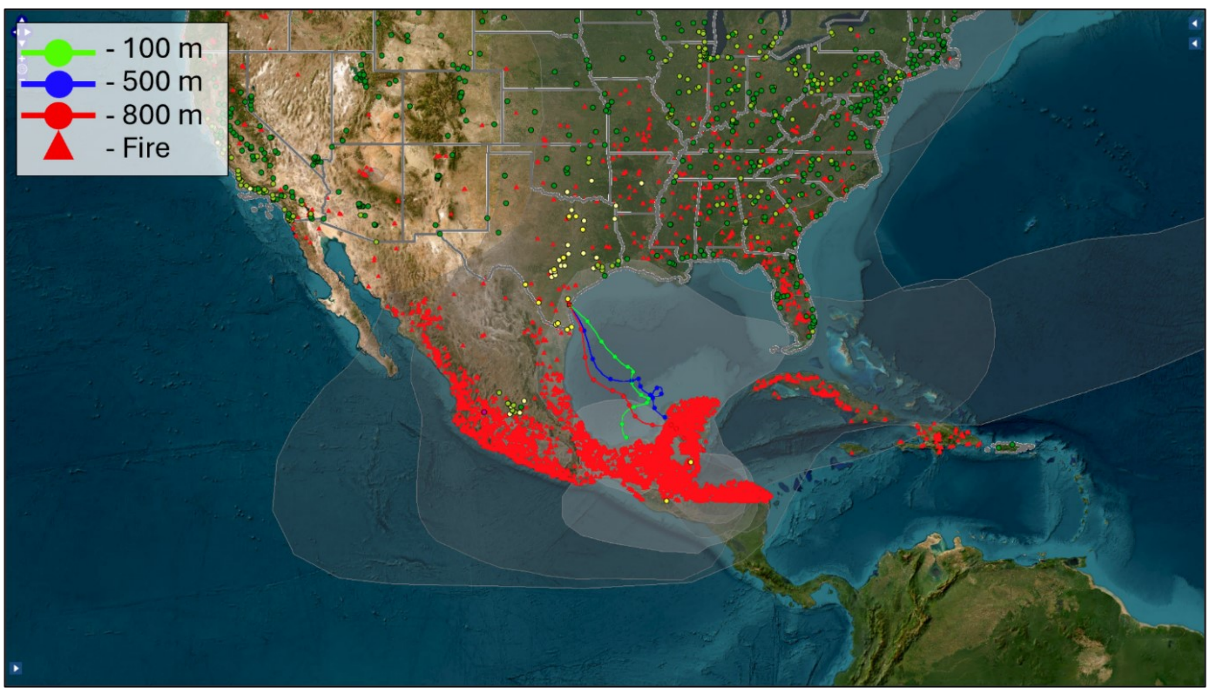


**Figure 3-100: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on May 21, 2024**

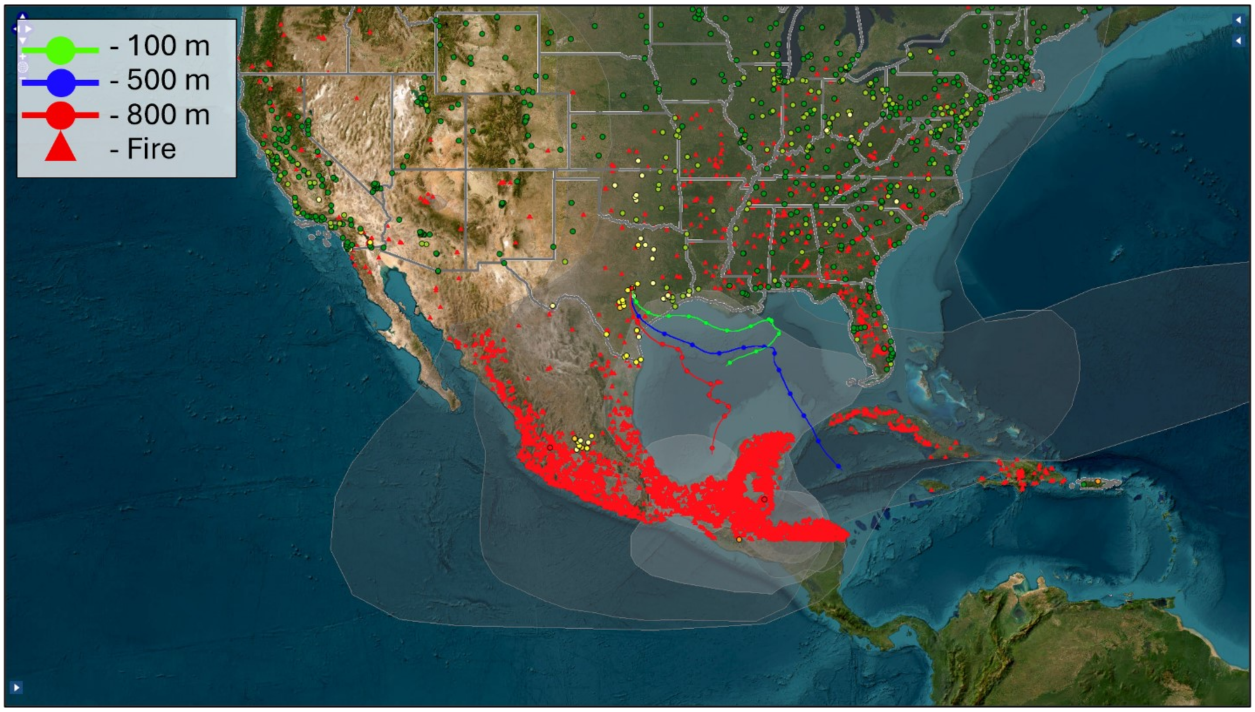

**Figure 3-101: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville Monitor on May 21, 2024**

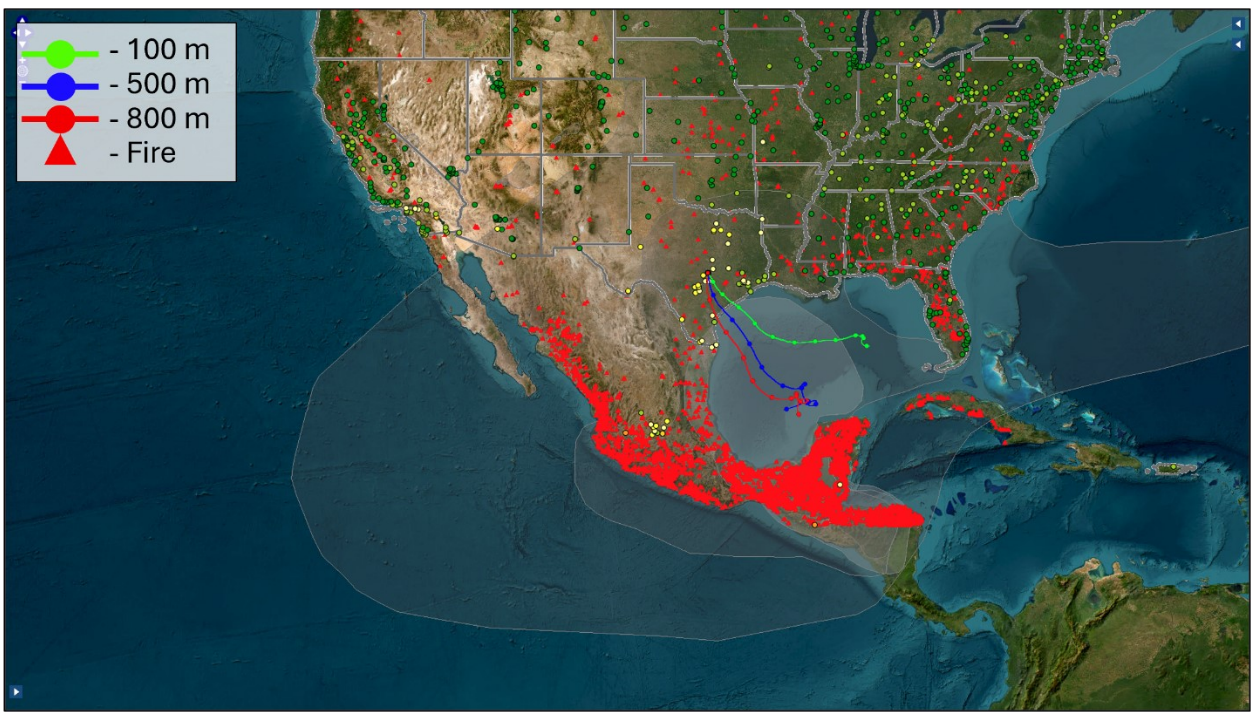

**Figure 3-102: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville Monitor on May 22, 2024**

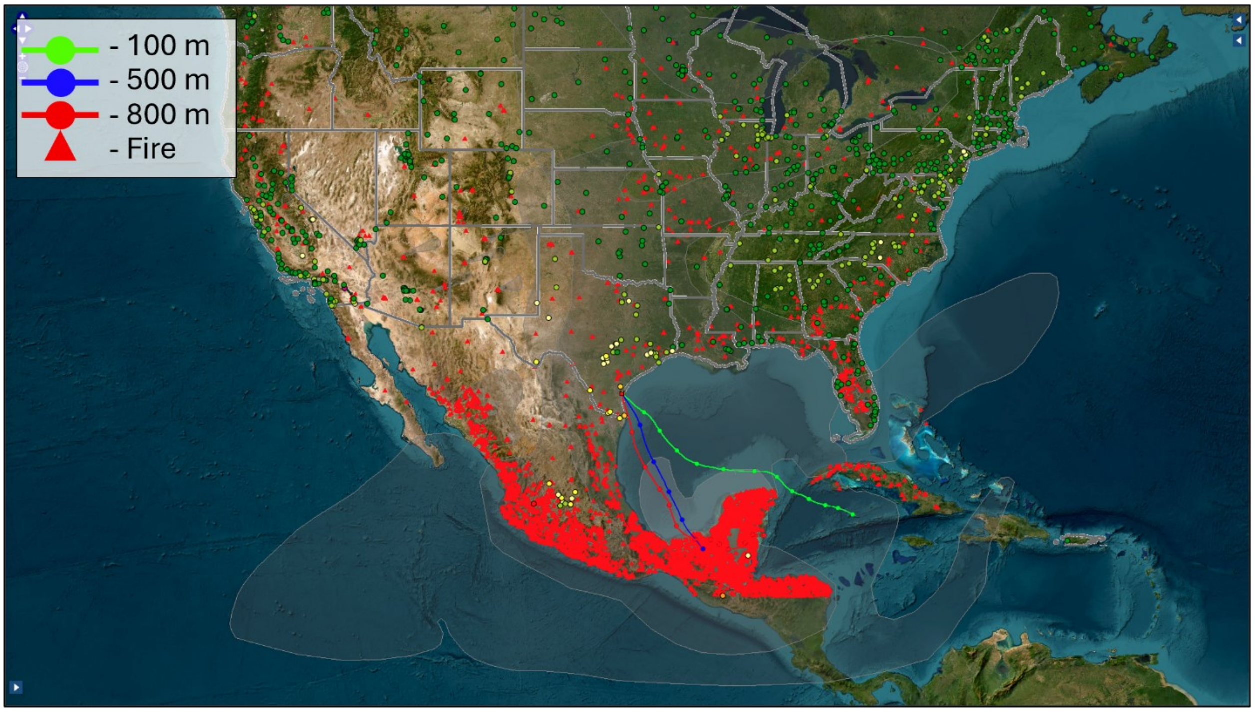


**Figure 3-103: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on May 23, 2024**


**Figure 3-104: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville Monitor on May 23, 2024**

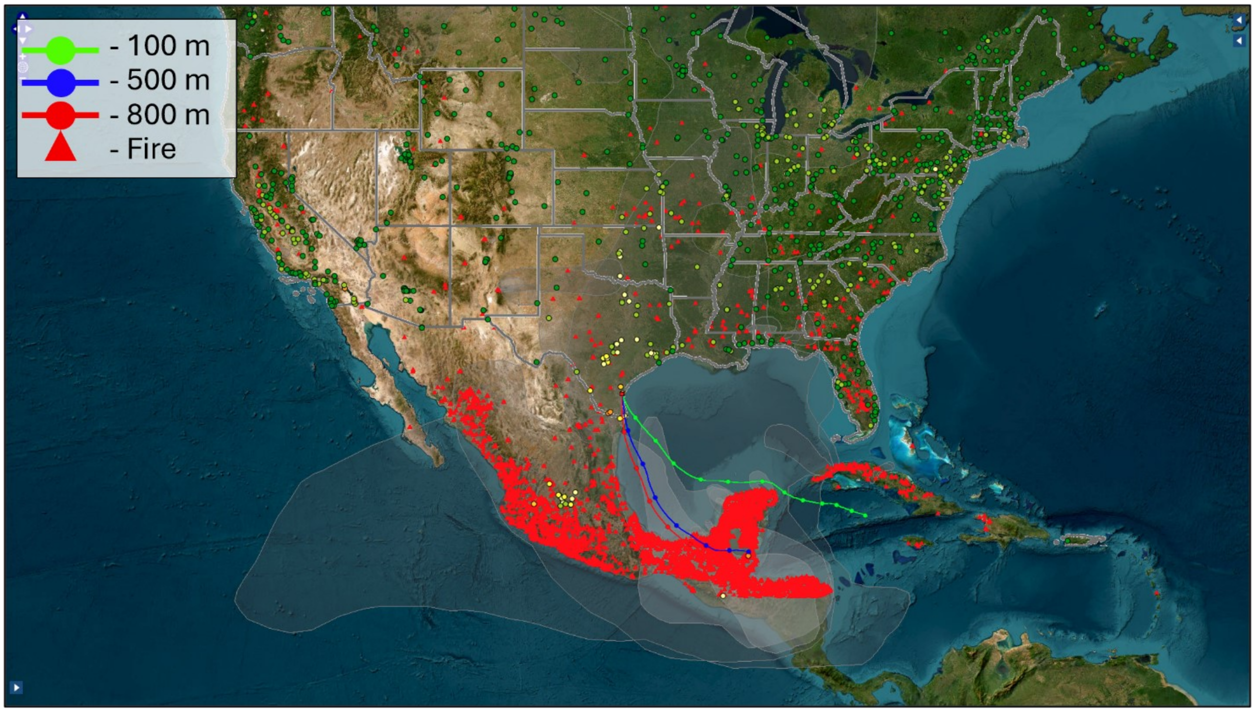

**Figure 3-105: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on May 24, 2024**

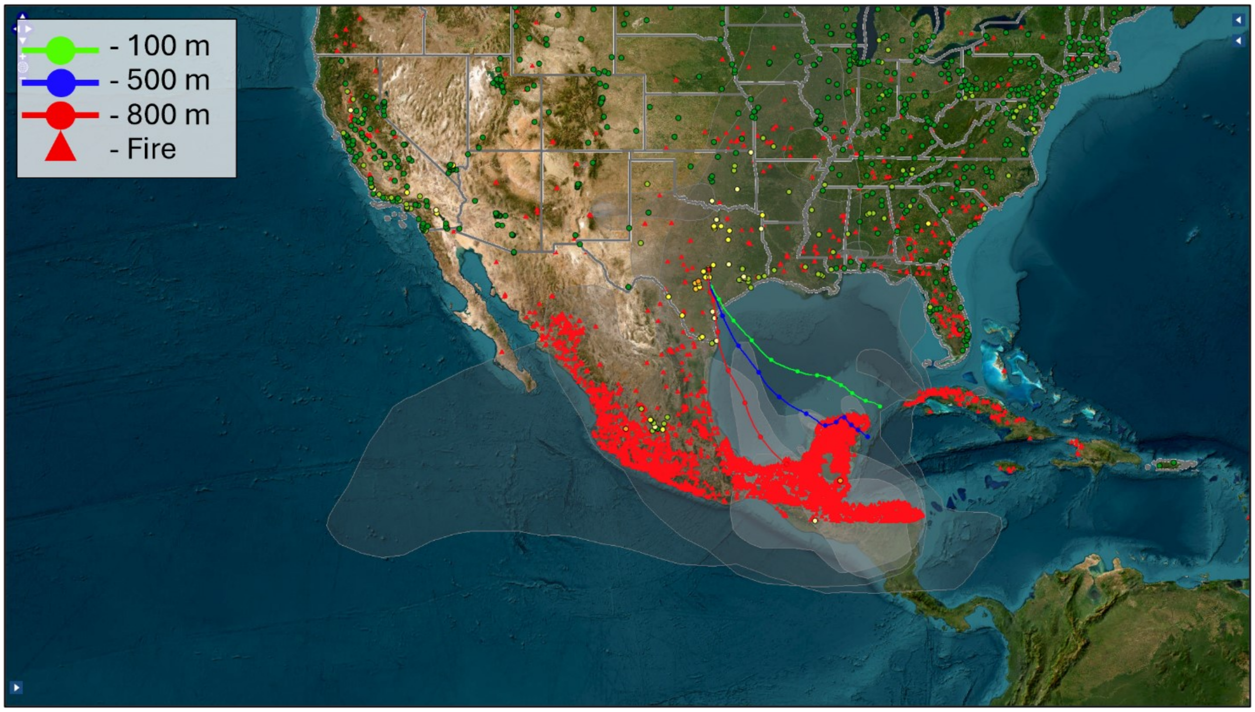

**Figure 3-106: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville Monitor on May 24, 2024**

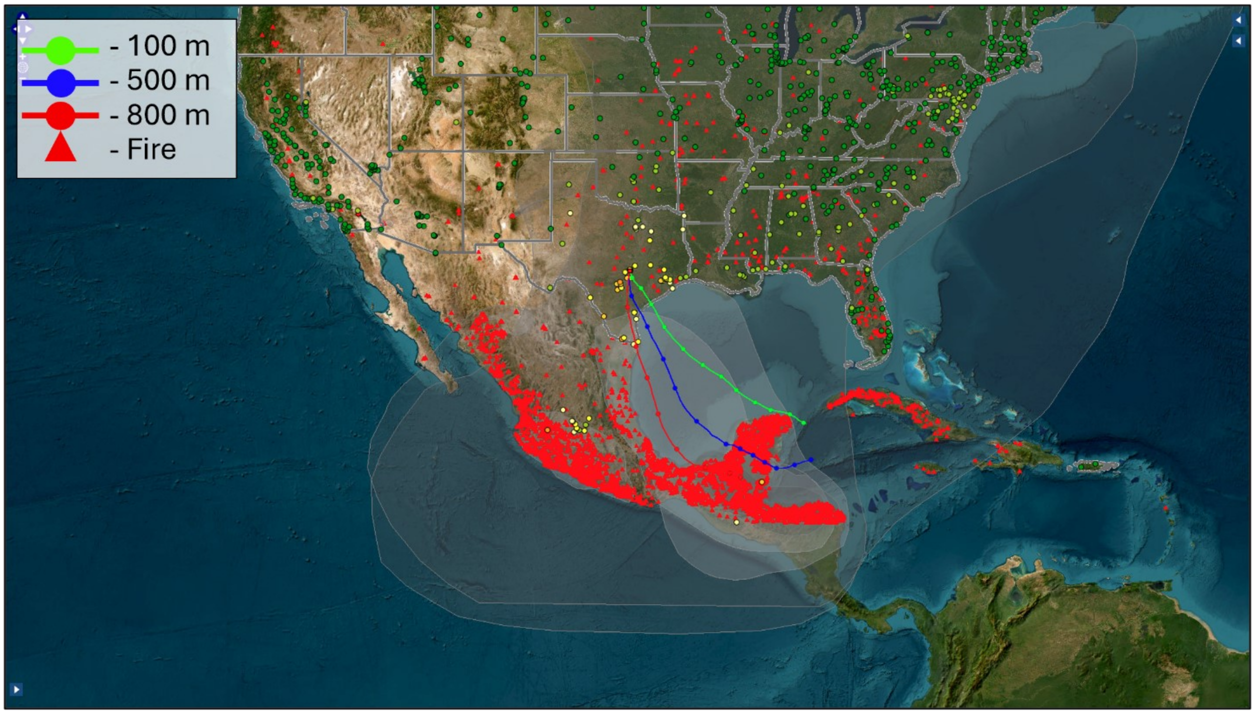

**Figure 3-107: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville Monitor on May 25, 2024**

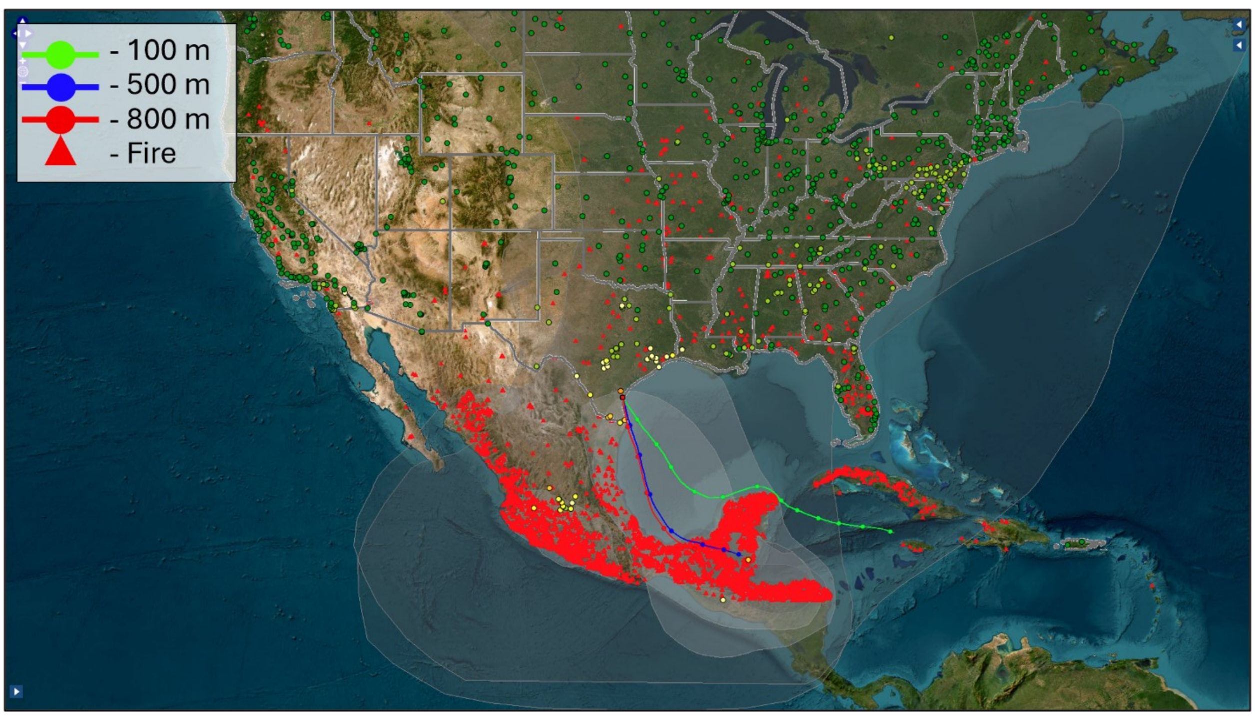

**Figure 3-108: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on May 25, 2024**


**Figure 3-109: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on May 26, 2024**

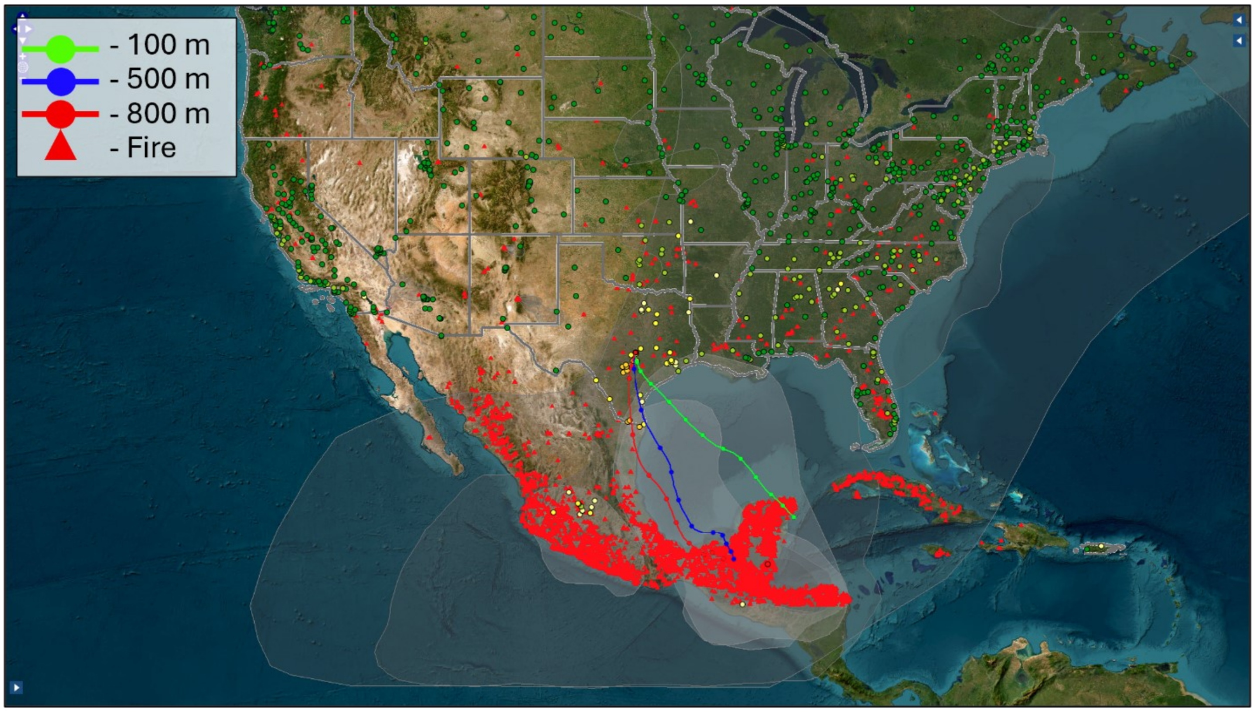


**Figure 3-110: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville Monitor on May 26, 2024**

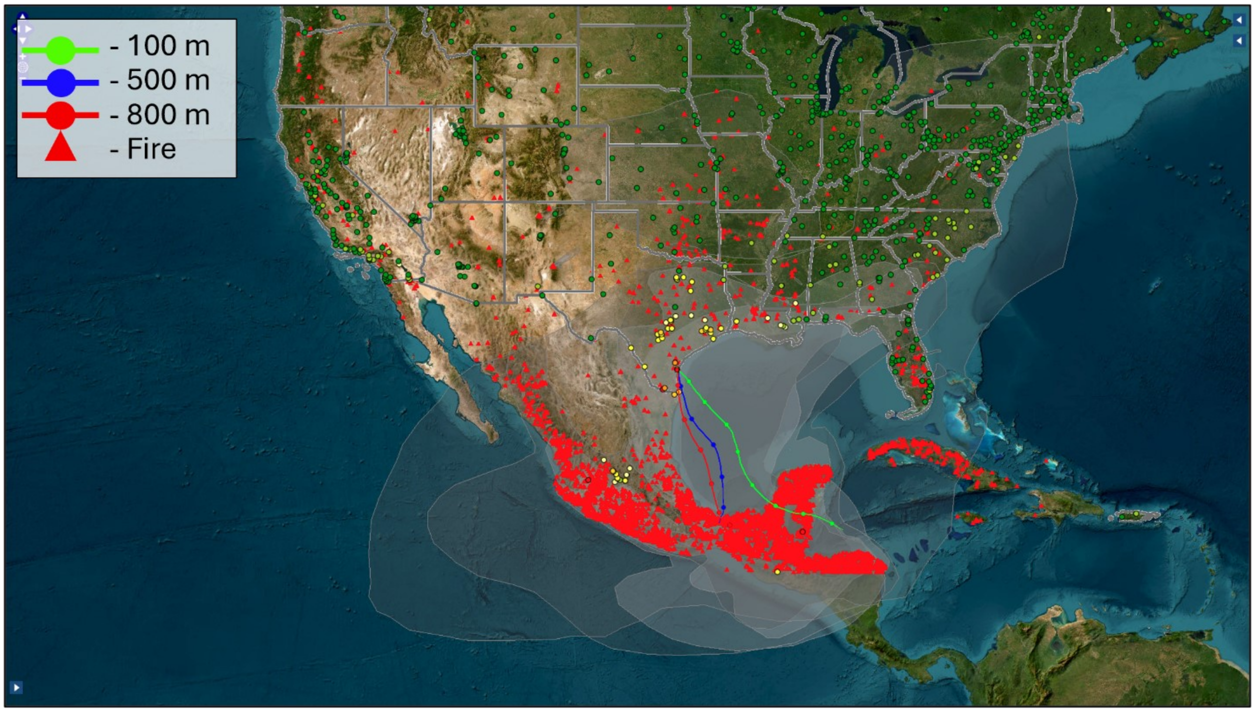


**Figure 3-111: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on May 27, 2024**

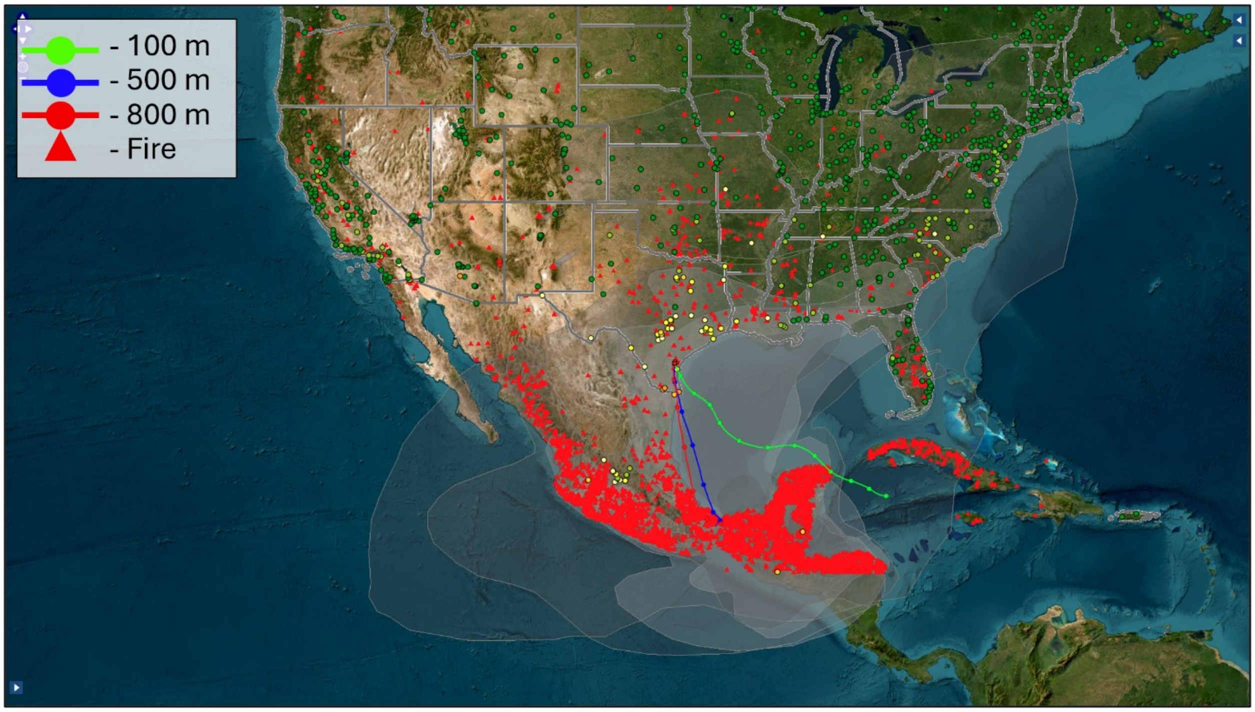


**Figure 3-112: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville Monitor on May 27, 2024**

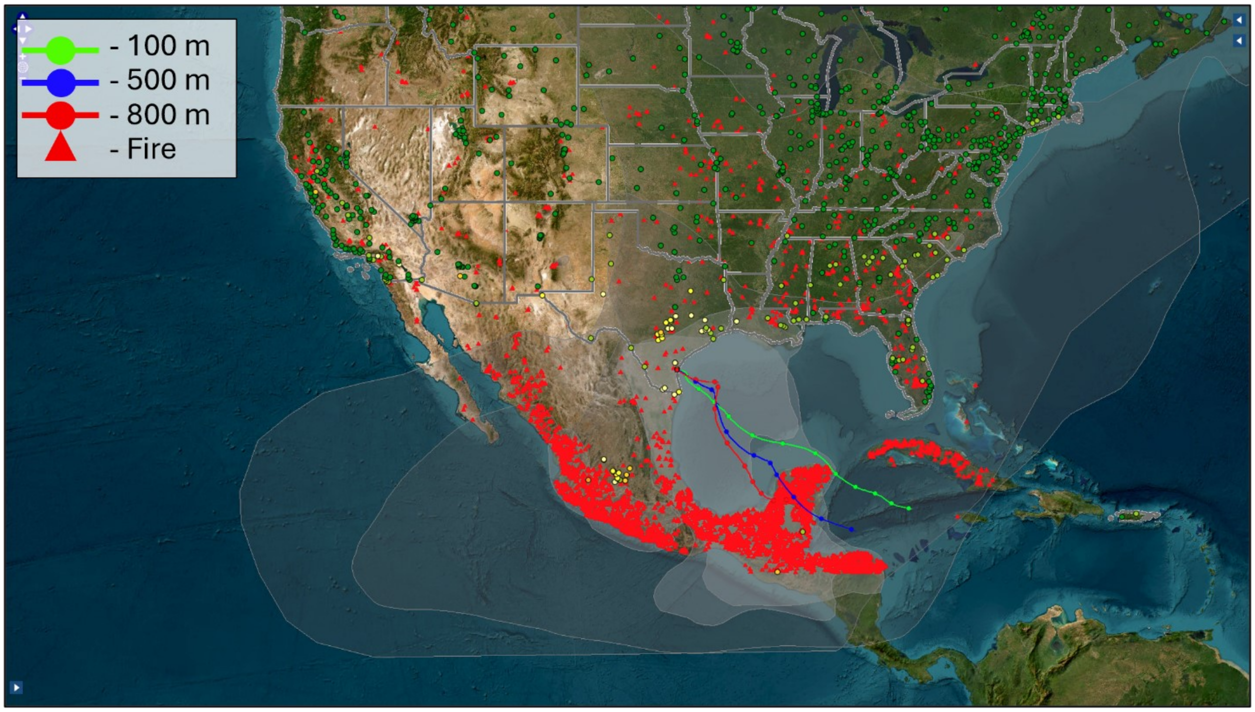


**Figure 3-113: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on May 28, 2024**

Finally, forward trajectories from the Yucatan Peninsula show transport to southern and central Texas from locations with fires and to the location of the Webberville and National Seashore monitoring sites. The forward trajectories are depicted in the following figures:

- Figure 3-114: *NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting May 16, 2024*
- Figure 3-115: *NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting May 18, 2024*
- Figure 3-116: *NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting May 19, 2024*
- Figure 3-117: *NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting May 20, 2024*
- Figure 3-118: *NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting May 21, 2024*
- Figure 3-119: *NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting May 22, 2024*
- Figure 3-120: *NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting May 25, 2024*

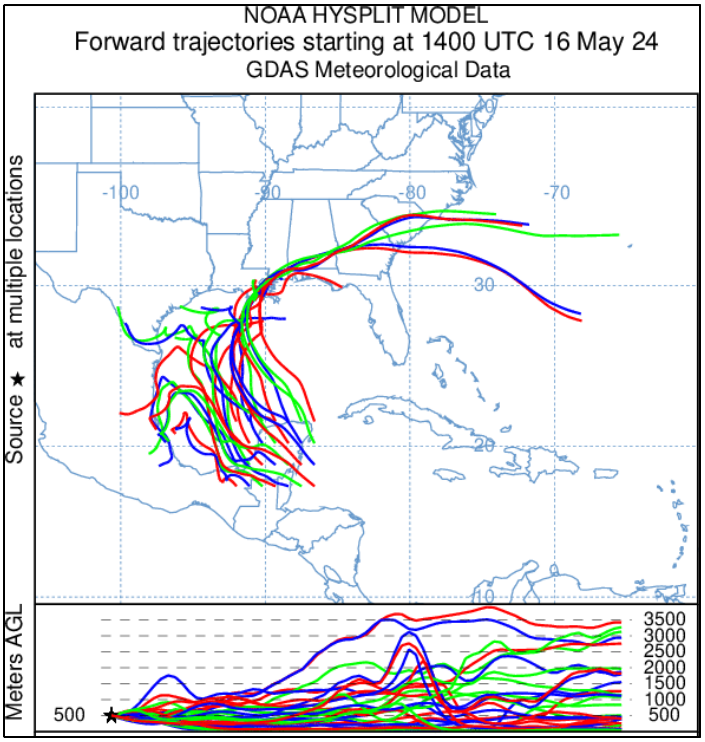


**Figure 3-114: NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting May 16, 2024**

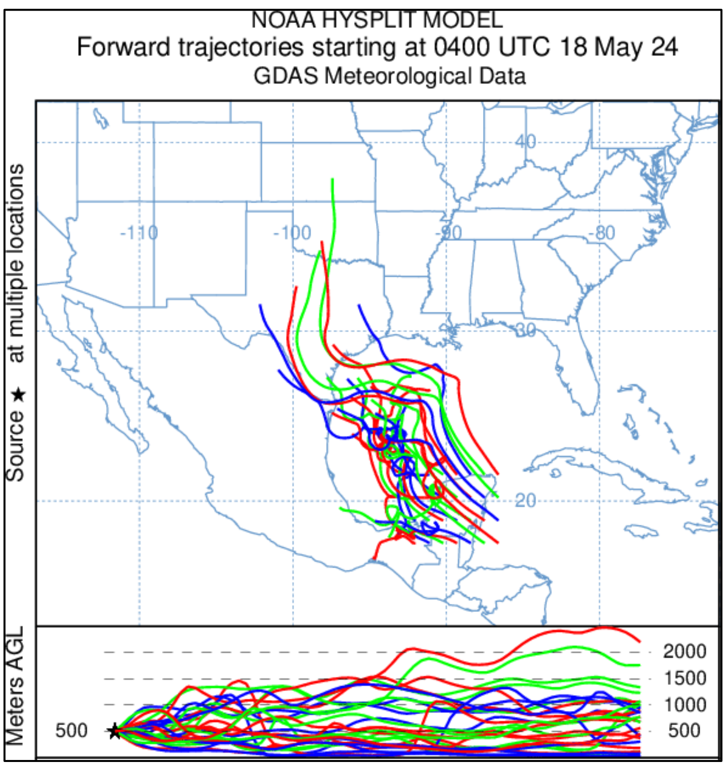


**Figure 3-115: NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting May 18, 2024**

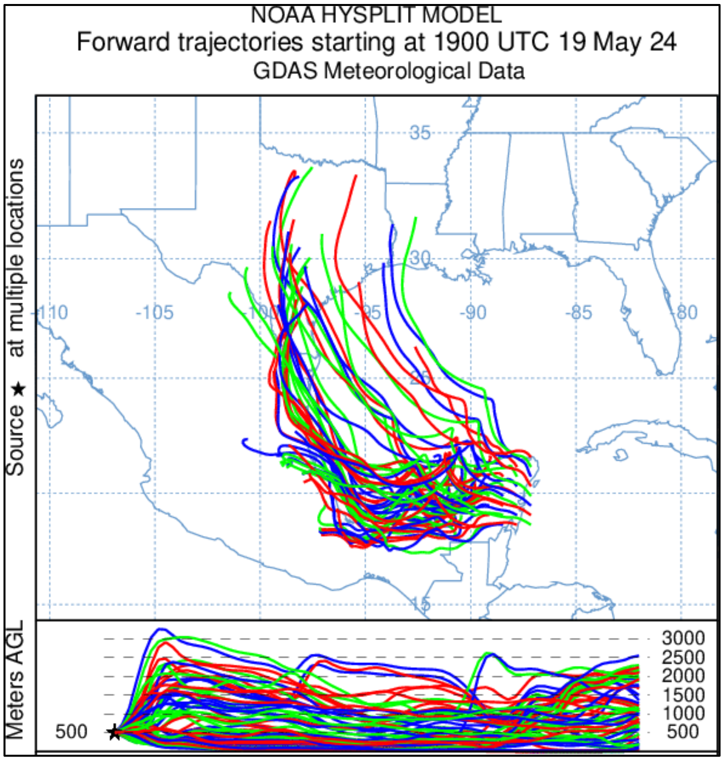


**Figure 3-116: NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting May 19, 2024**

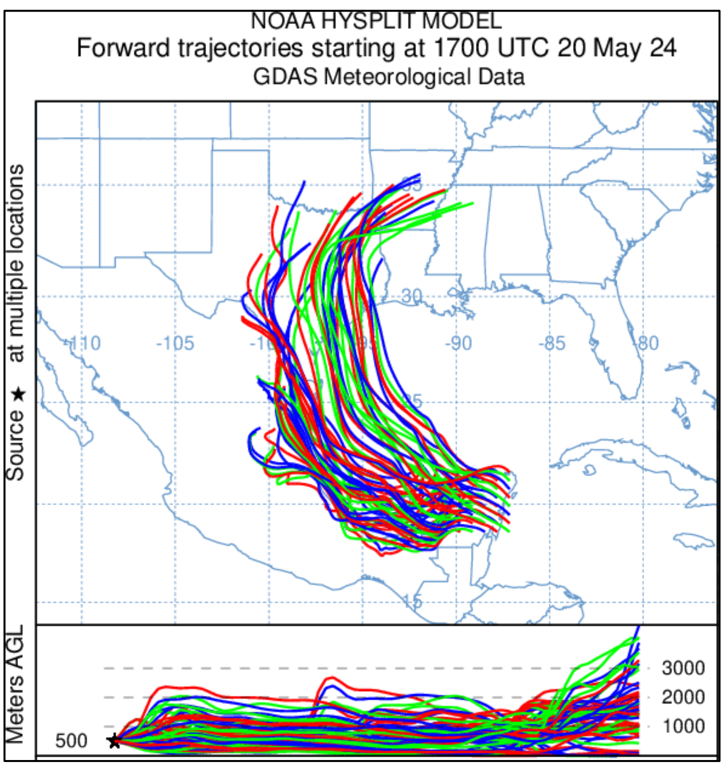


**Figure 3-117: NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting May 20, 2024**

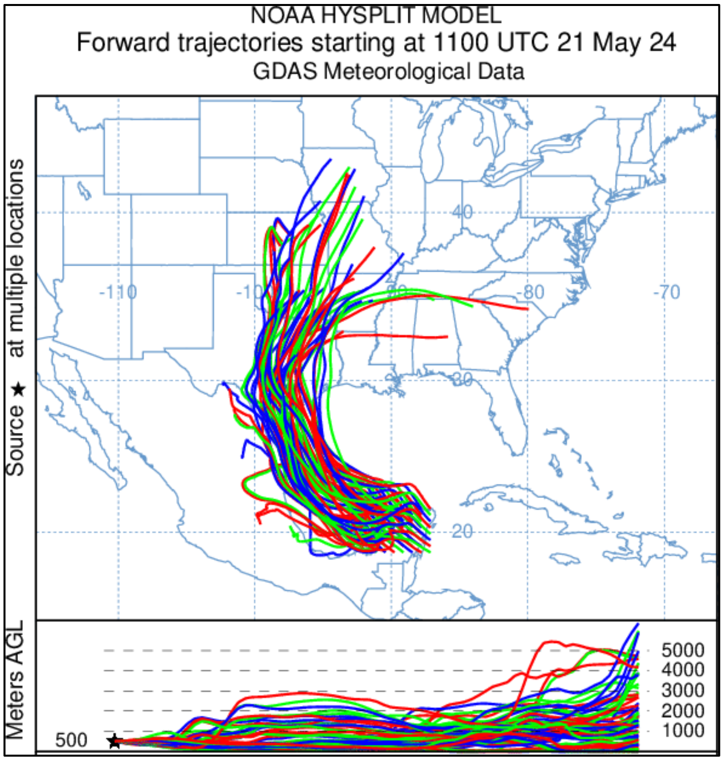


**Figure 3-118: NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting May 21, 2024**

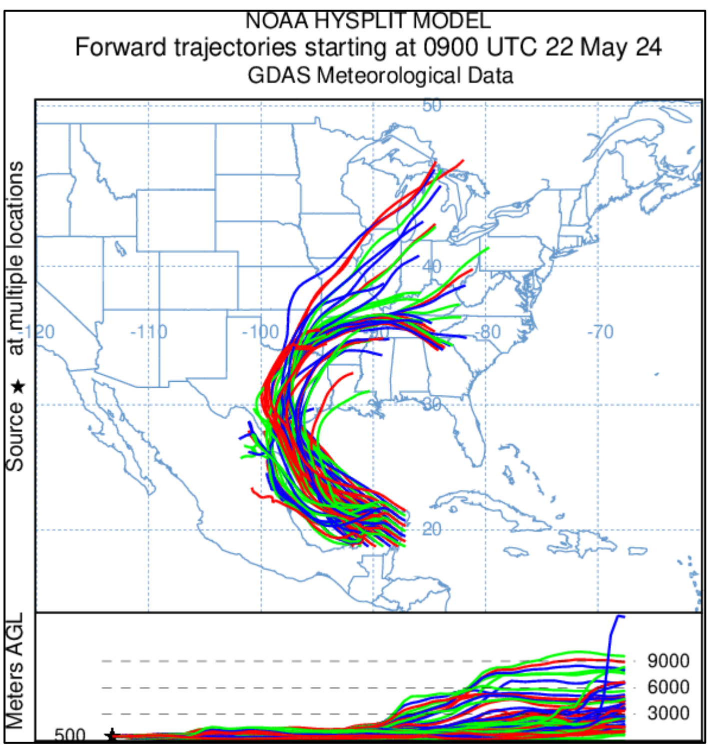


**Figure 3-119: NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting May 22, 2024**

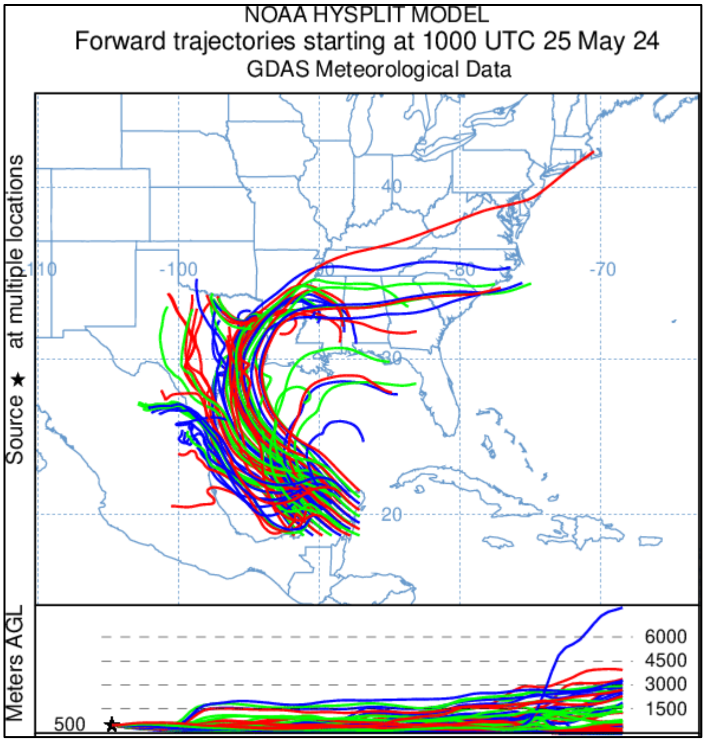


**Figure 3-120: NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting May 25, 2024**

### 3.2.13 Group 13 - Evidence for June 3 through June 6, 2024, Fire (Mexico/Central America) $PM_{2.5}$ Event for the Webberville and National Seashore Monitors

The National Seashore monitor experienced exceedances influenced by exceptional events from June 3, through June 6, 2024. The Webberville monitor also experienced an event on June 4, 2024. All of these events were tied to fires in Mexico. The daily $PM_{2.5}$ average concentrations and tiers for each monitor and day are shown in Table 3-3: *Summary of Event Dates and Measurements for Group 13 Events.*

**Table 3-3: Summary of Event Dates and Measurements for Group 13 Events**

| Date | Monitor | Exceedance Concentration | Tier |
|---|---|---|---|
| 06/03/24 | National Seashore | 25.6 | 2 |
| 06/04/24 | Webberville | 32.3 | 1 |
| 06/04/24 | National Seashore | 30.6 | 1 |
| 06/05/24 | National Seashore | 35.7 | 1 |
| 06/06/24 | National Seashore | 27.4 | 2 |

Figure 3-121: *Hourly $PM_{2.5}$ Concentrations on June 3, 2024, Compared to Typical Concentrations at the National Seashore Monitor*, Figure 3-122: *Hourly $PM_{2.5}$ Concentrations on June 4, 2024, Compared to Typical Concentrations at the National Seashore Monitor*, Figure 3-123: *Hourly $PM_{2.5}$ Concentrations on June 4, 2024, Compared to Typical Concentrations at the Webberville Monitor*, Figure 3-124: *Hourly $PM_{2.5}$ Concentrations on June 5, 2024, Compared to Typical Concentrations at the National Seashore Monitor*, and Figure 3-125: *Hourly $PM_{2.5}$ Concentrations on June 6, 2024, Compared to Typical Concentrations at the National Seashore Monitor*, all show the concentrations at the monitoring sites for each day compared to normal days.

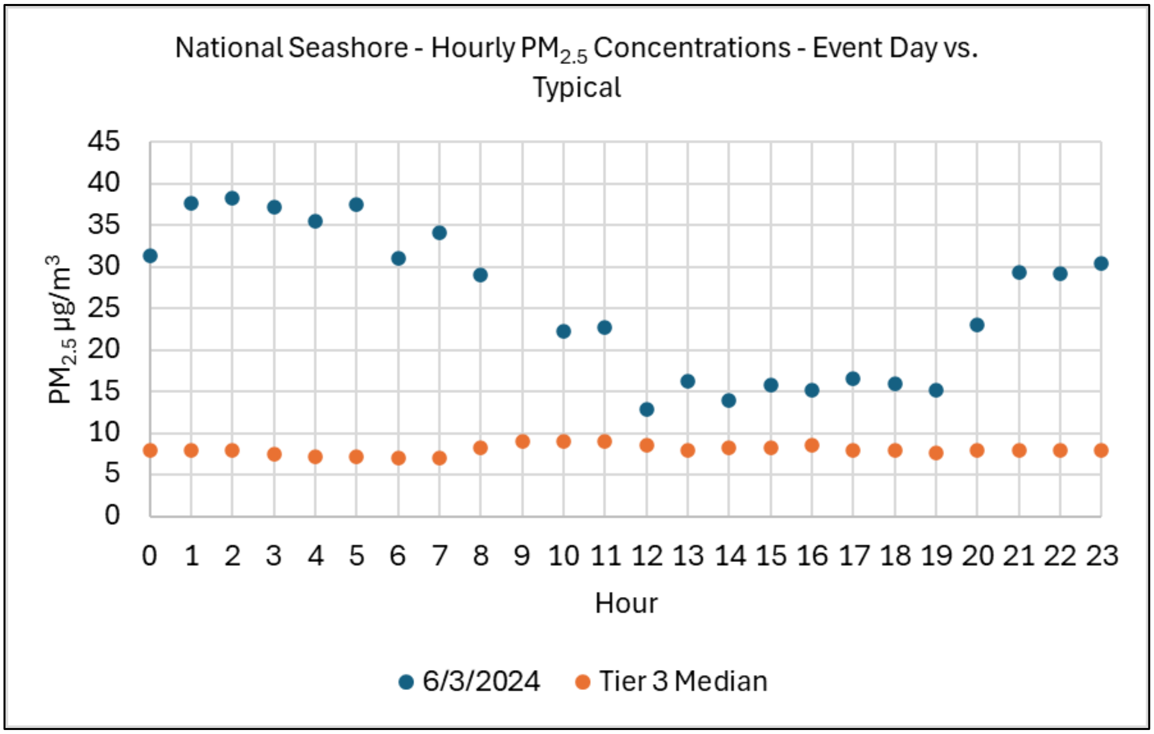


**Figure 3-121: Hourly $PM_{2.5}$ Concentrations on June 3, 2024, Compared to Typical Concentrations at the National Seashore Monitor**

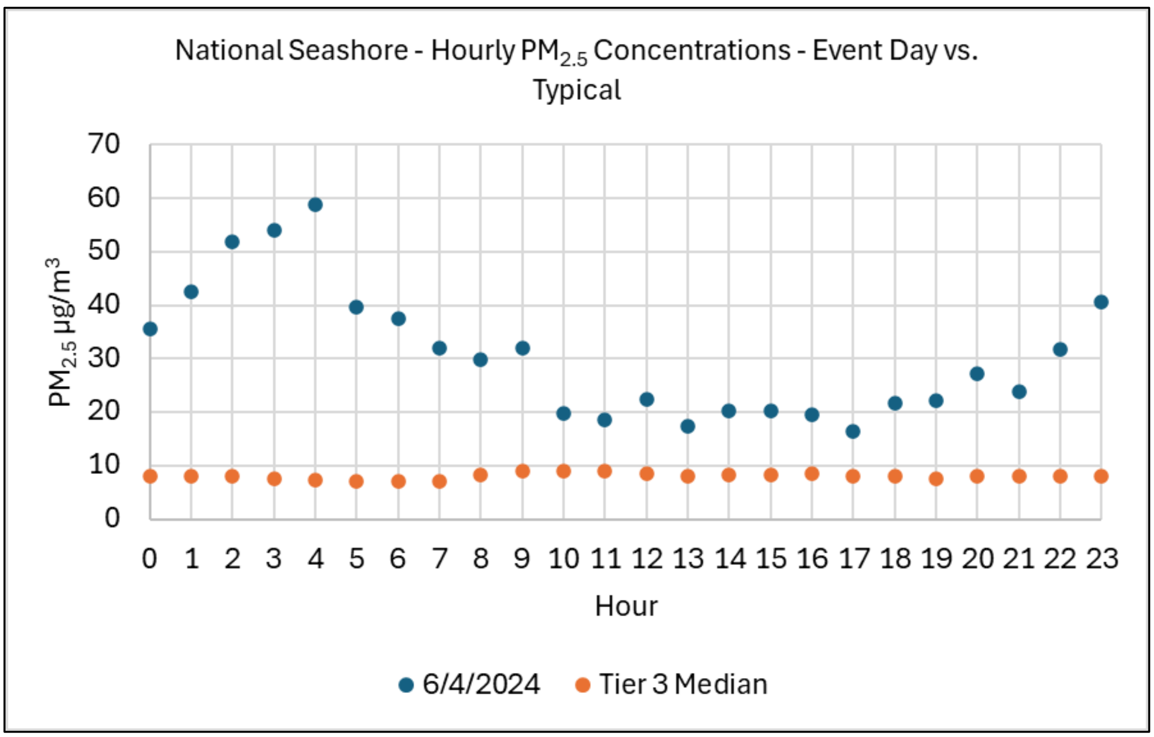


**Figure 3-122: Hourly $PM_{2.5}$ Concentrations on June 4, 2024, Compared to Typical Concentrations at the National Seashore Monitor**

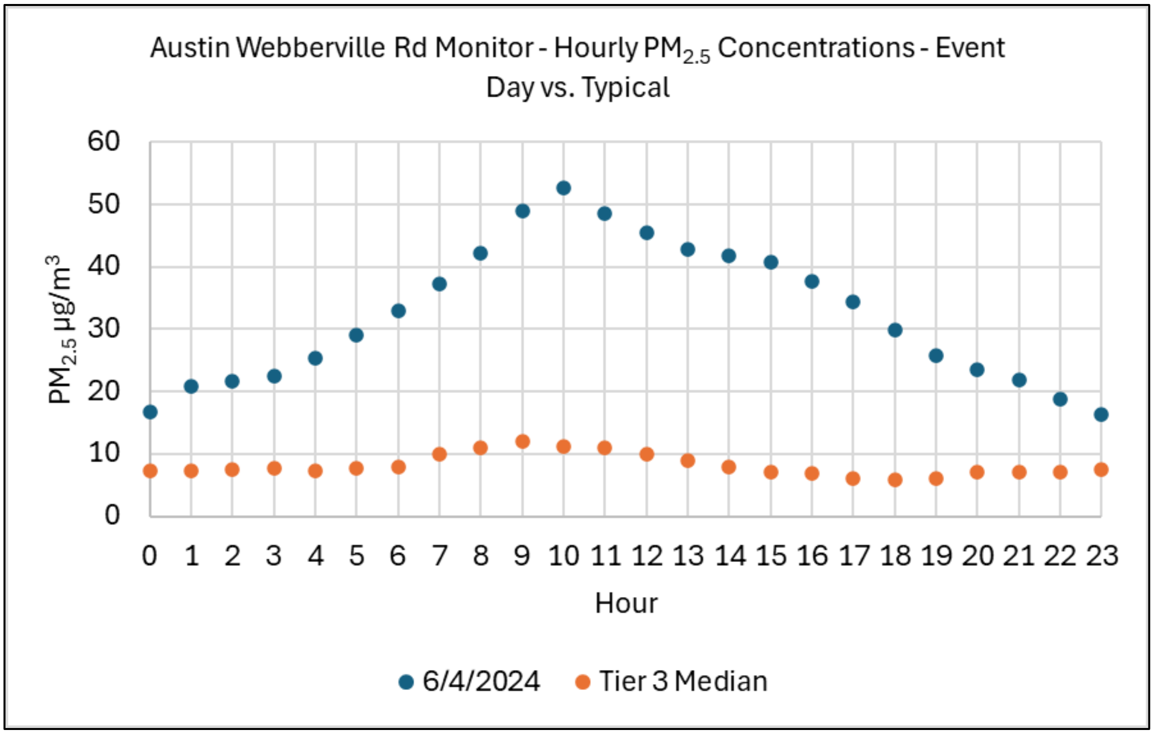


**Figure 3-123: Hourly $PM_{2.5}$ Concentrations on June 4, 2024, Compared to Typical Concentrations at the Webberville Monitor**

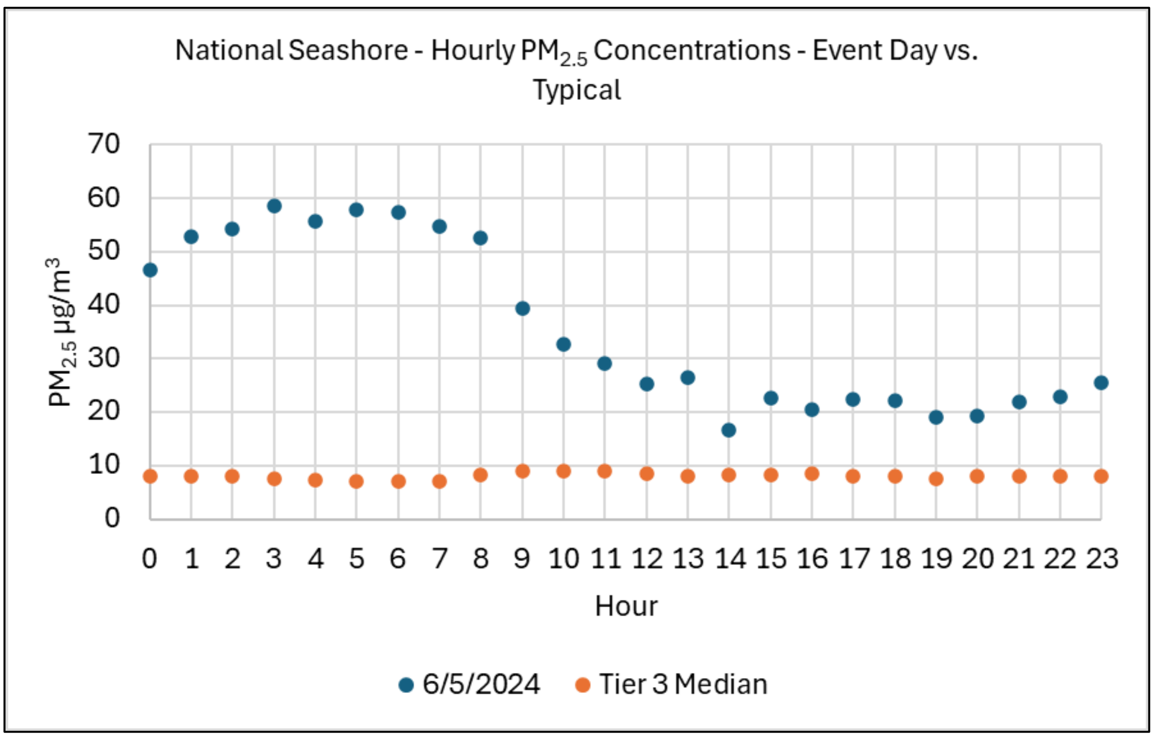


**Figure 3-124: Hourly $PM_{2.5}$ Concentrations on June 5, 2024, Compared to Typical Concentrations at the National Seashore Monitor**

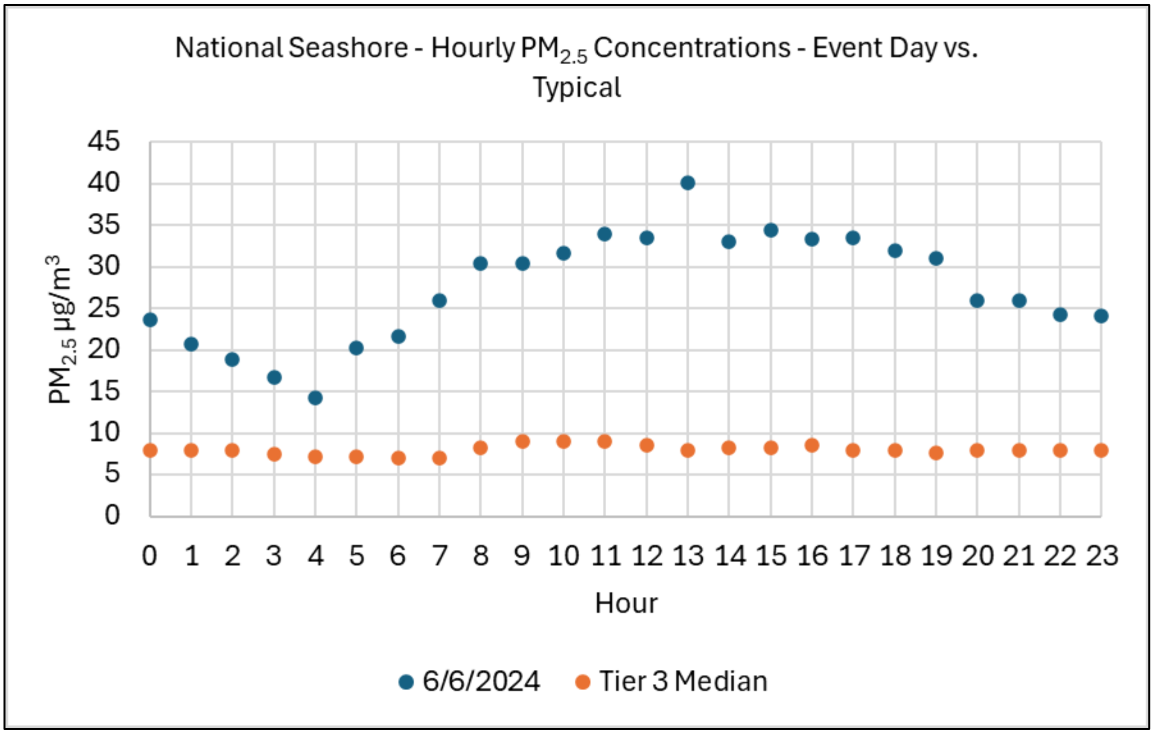


**Figure 3-125: Hourly $PM_{2.5}$ Concentrations on June 6, 2024, Compared to Typical Concentrations at the National Seashore Monitor**

Figure 3-126: *AirNow HMS Smoke Plume for June 4, 2024*, Figure 3-127: *AirNow HMS Smoke Plume for June 5, 2024*, and Figure 3-128: *AirNow HMS Smoke Plume for June 6, 2024*, all show the presence of smoke plumes over the National Seashore and Webberville monitoring sites.

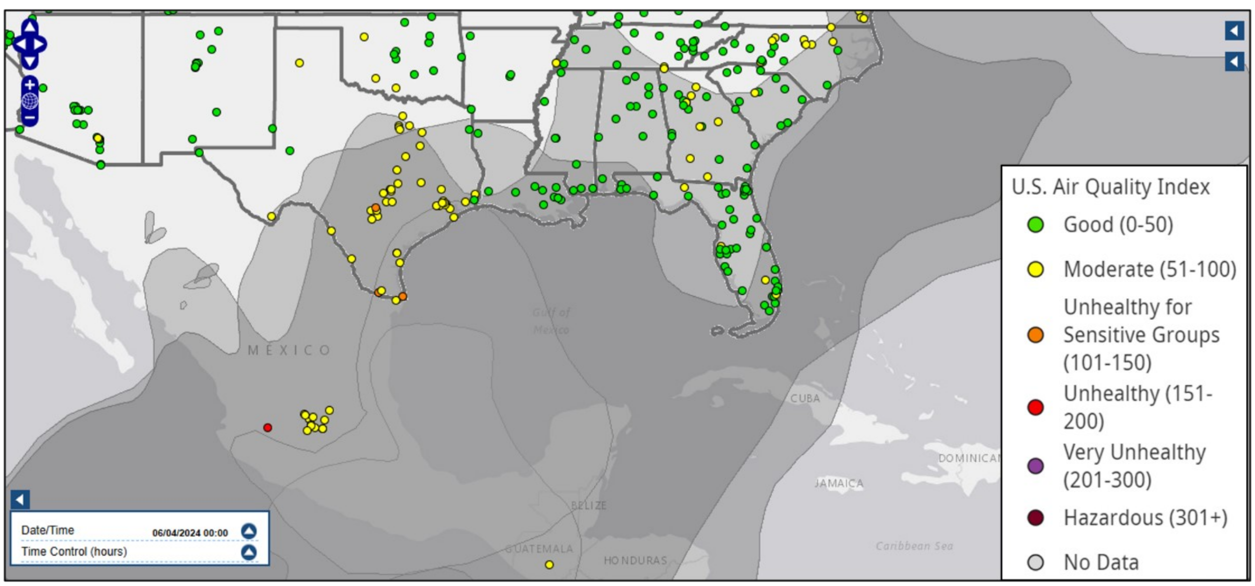


**Figure 3-126: AirNow HMS Smoke Plume for June 4, 2024**

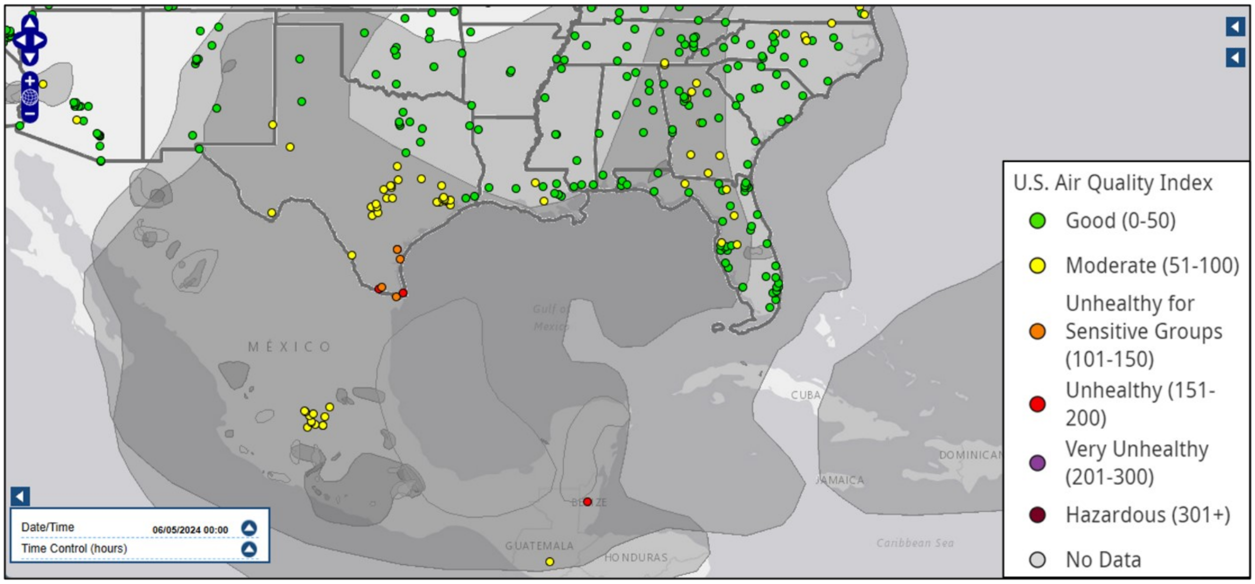


**Figure 3-127: AirNow HMS Smoke Plume for June 5, 2024**

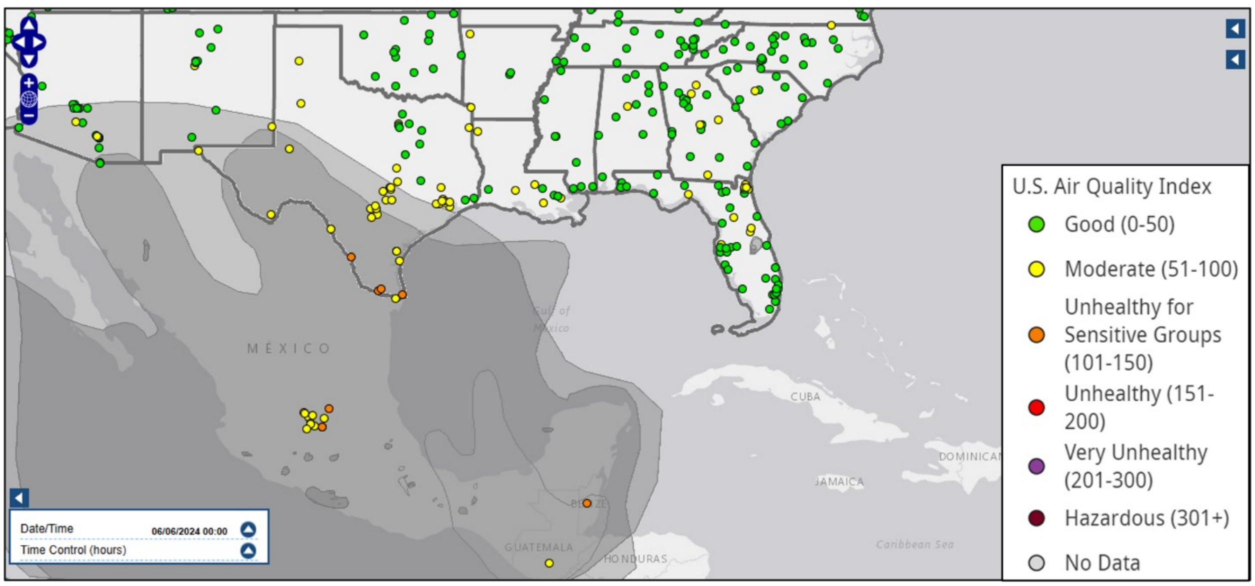


**Figure 3-128: AirNow HMS Smoke Plume for June 6, 2024**

Figure 3-129: *AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on June 3, 2024*, Figure 3-130: *AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on June 4, 2024*, Figure 3-131: *AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville Monitor on June 4, 2024*, Figure 3-132: *AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on June 5, 2024*, and Figure 3-133: *AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on June 6, 2024*, all show trajectories going backwards from the Webberville and National Seashore monitors to southern Mexico (including the Yucatan Peninsula).

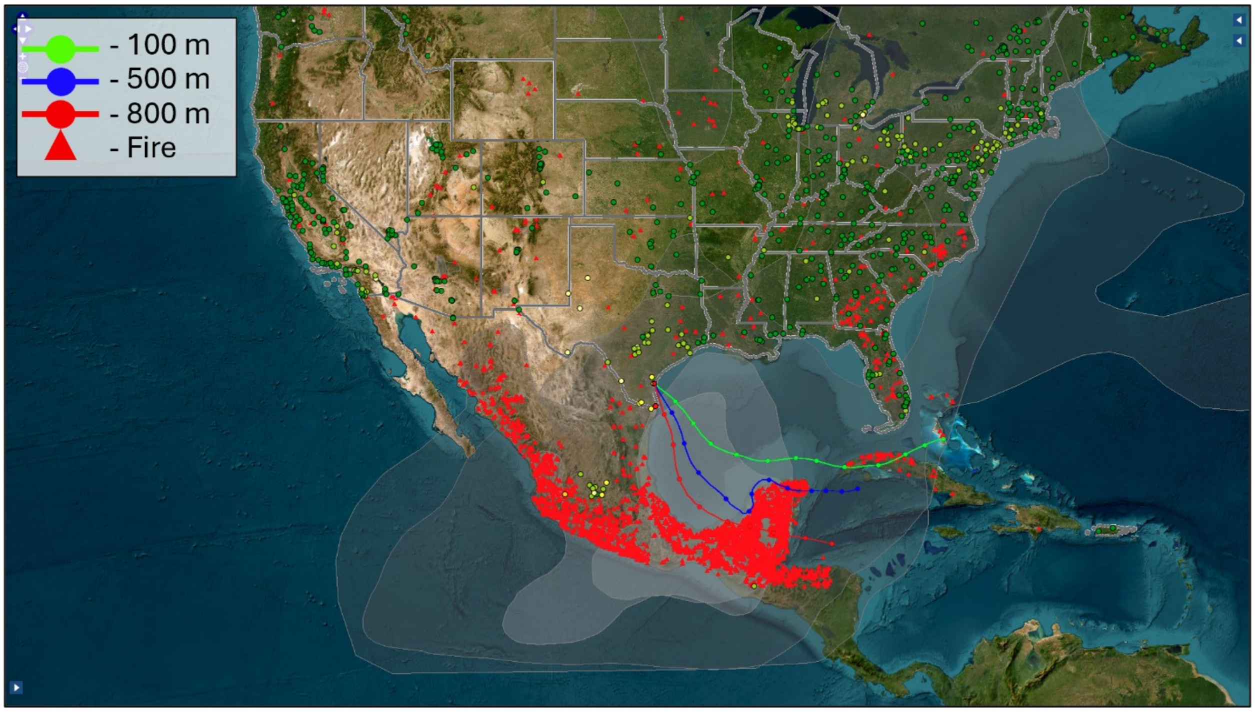

**Figure 3-129: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on June 3, 2024**

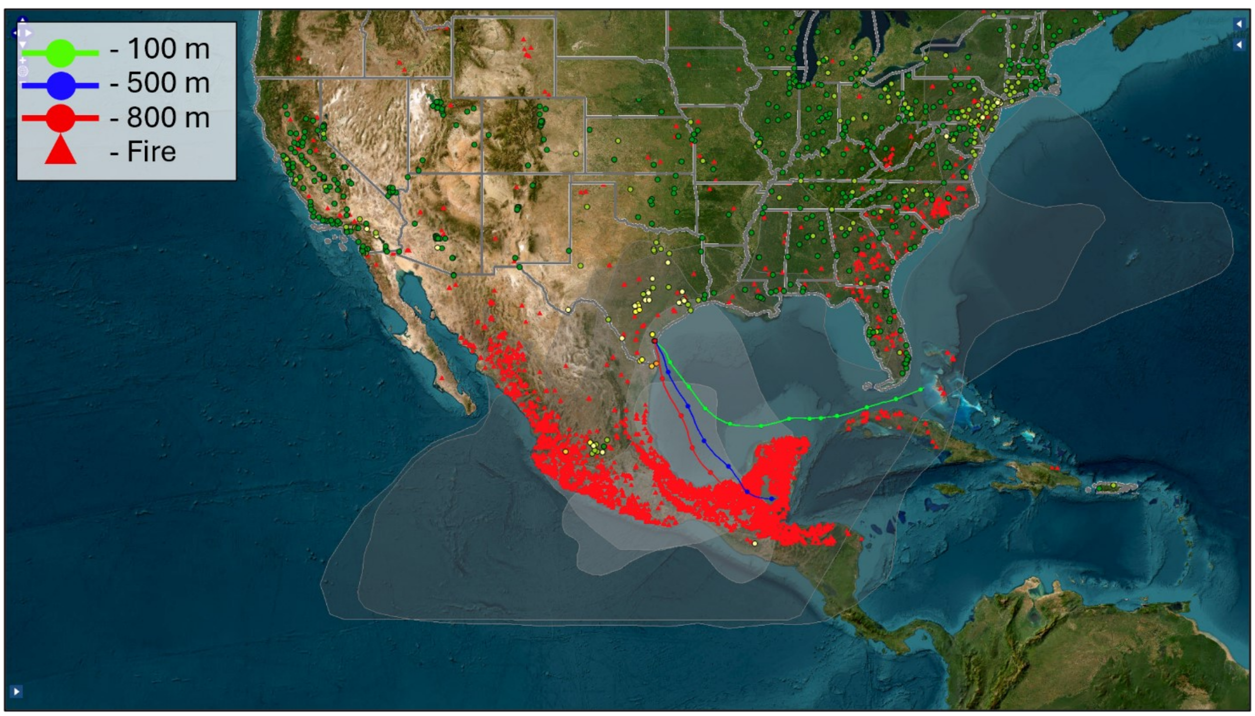

**Figure 3-130: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on June 4, 2024**

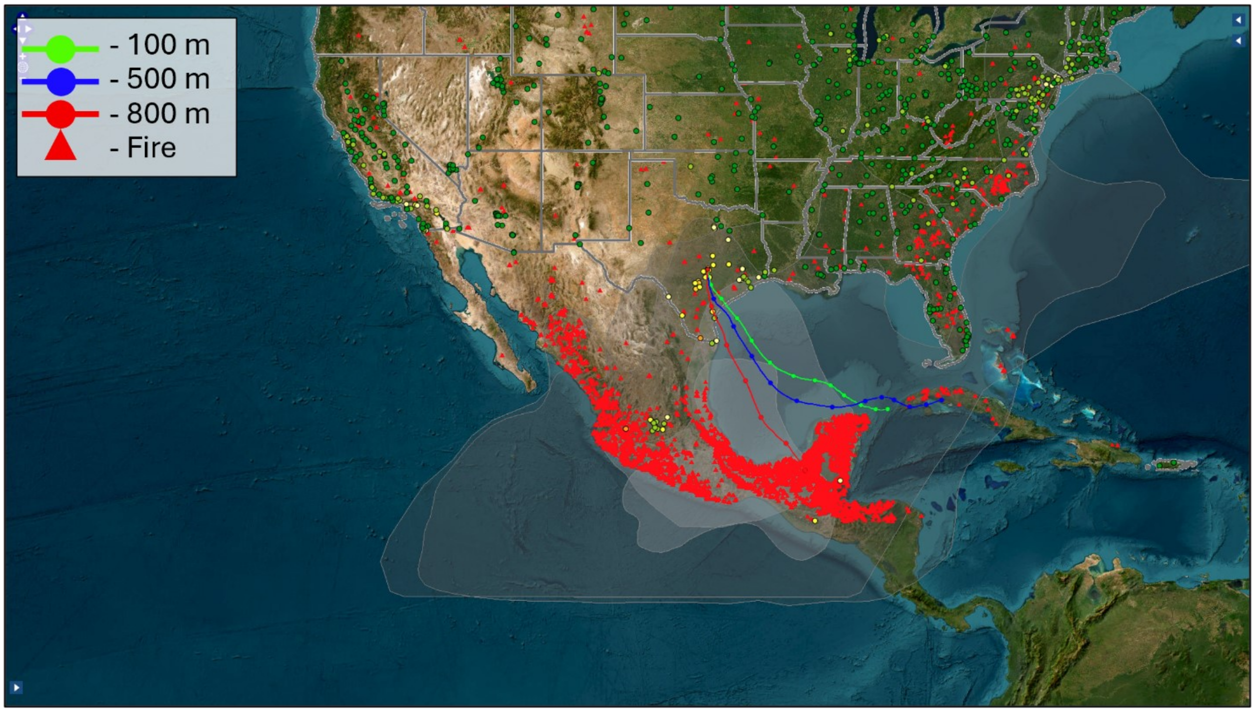

Figure 3-131: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the Webberville Monitor on June 4, 2024

Figure 3-132: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on June 5, 2024

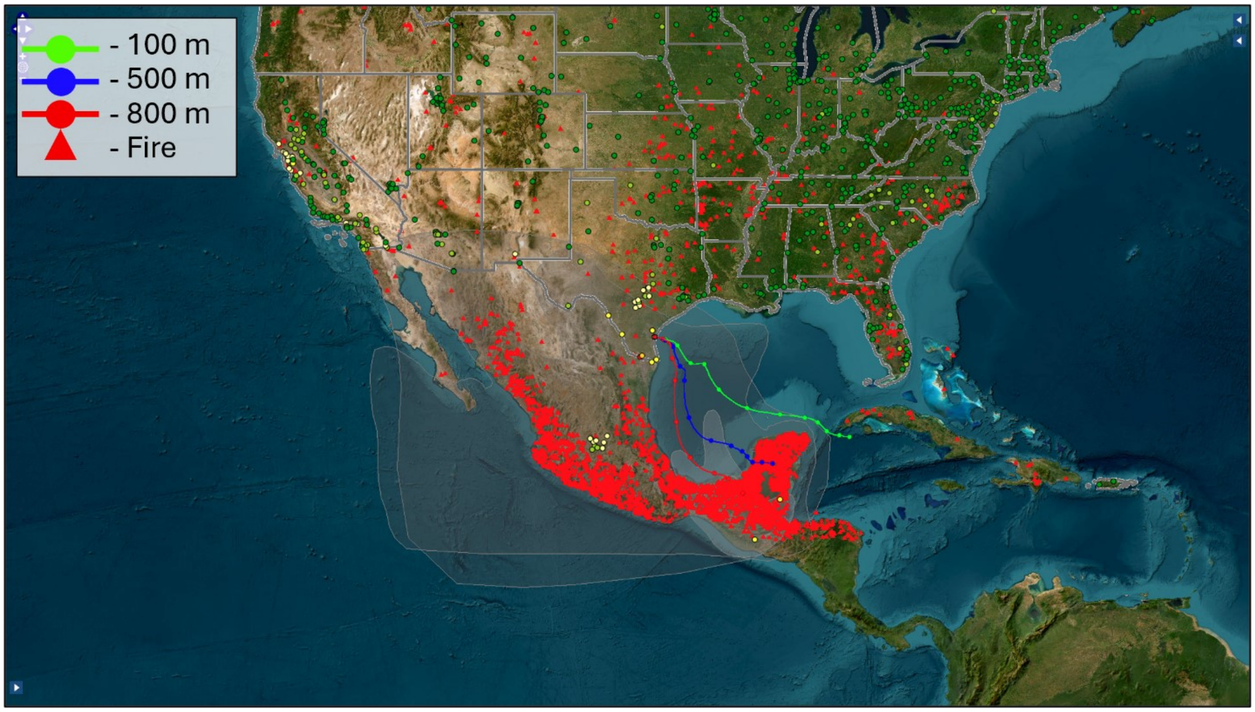

**Figure 3-133: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on June 6, 2024**

Figure 3-134: *NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting on May 31, 2024*, Figure 3-135: *NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting on June 2, 2024*, and Figure 3-136: *NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting on June 3, 2024*, all show HYSPLIT forward trajectories (initiated at 100 meters above ground level) showing direct transport of fire emissions from the Yucatan Peninsula to the Texas Gulf Coast and central Texas.

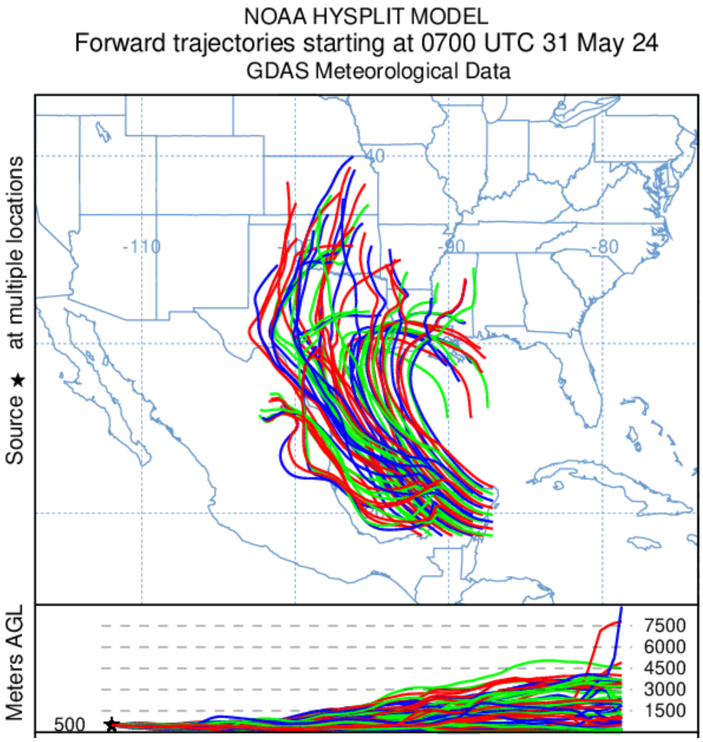


**Figure 3-134: NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting on May 31, 2024**

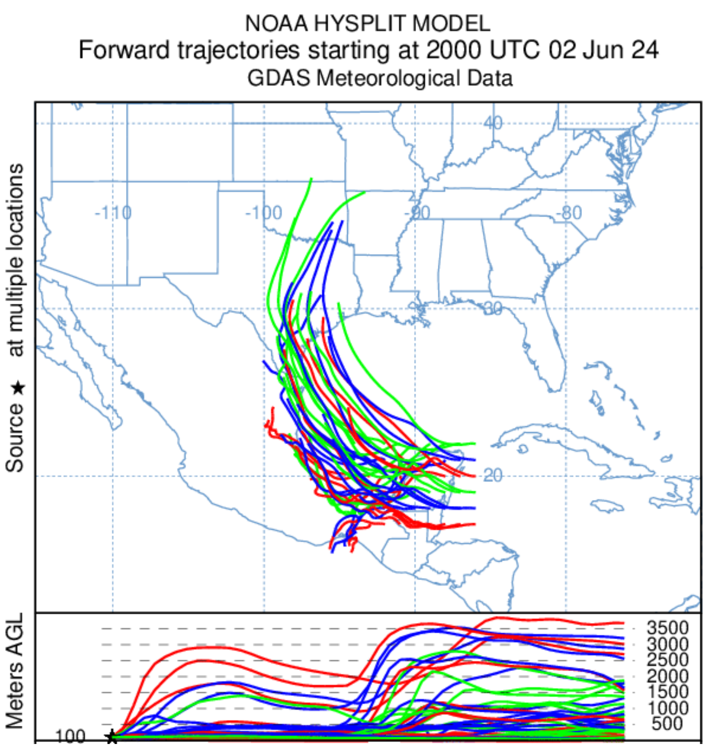


**Figure 3-135: NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting on June 2, 2024**

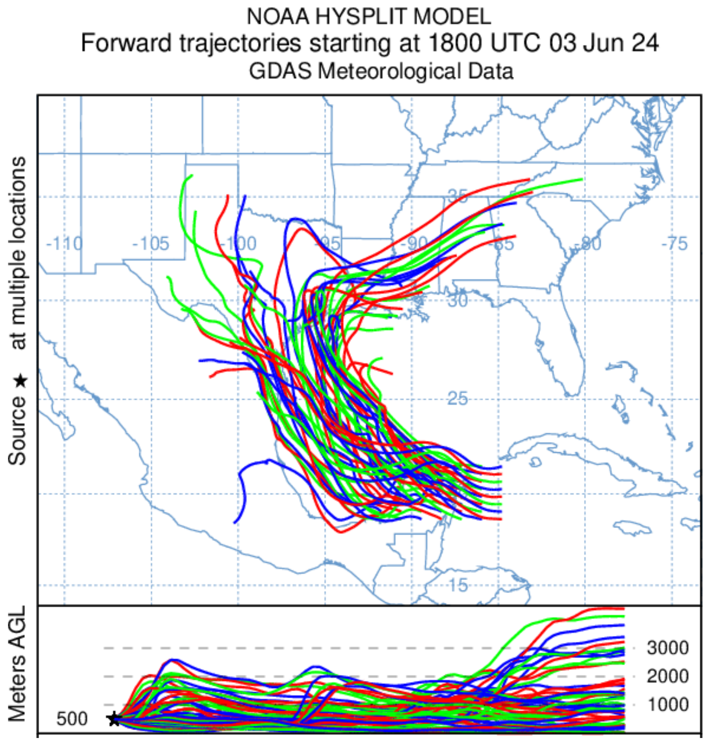


**Figure 3-136: NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Areas in Mexico with Fires, Starting on June 3, 2024:**

### 3.2.14 Group 14 – Evidence for July 30 through August 1, 2024, African Dust for the National Seashore and Webberville Monitors

On July 30 through August 1, 2024, the Webberville and National Seashore monitoring sites experienced exceptional events that were attributable to Saharan dust transported from western Africa. Table 3-4: *Summary of Event Dates and Measurements for Group 14 Events* shows the daily average $PM_{2.5}$ on event days and the corresponding tiers.

**Table 3-4: Summary of Event Dates and Measurements for Group 14 Events**

| Date | Monitor | Exceedance Concentration | Tier |
|---|---|---|---|
| 07/30/24 | National Seashore | 25 | 2 |
| 07/31/24 | Webberville | 37.5 | 1 |
| 07/31/24 | National Seashore | 34.1 | 1 |
| 08/01/24 | Webberville | 29.0 | 1 |

Figure 3-137: *Hourly $PM_{2.5}$ Concentrations for July 30, 2024, Compared to Typical Concentrations at the National Seashore Monitor*, Figure 3-138: *Hourly $PM_{2.5}$ Concentrations on July 31, 2024, Compared to Typical Concentrations at the National Seashore Monitor*, Figure 3-139: *Hourly $PM_{2.5}$ Concentrations on July 31, 2024, Compared to Typical Concentrations at the Webberville Monitor*, and Figure 3-140: *Hourly $PM_{2.5}$ Concentrations on August 1, 2024, Compared to Typical Concentrations at the Webberville Monitor* all show that hourly concentrations at these monitors were substantially above the hourly concentrations of a normal day.

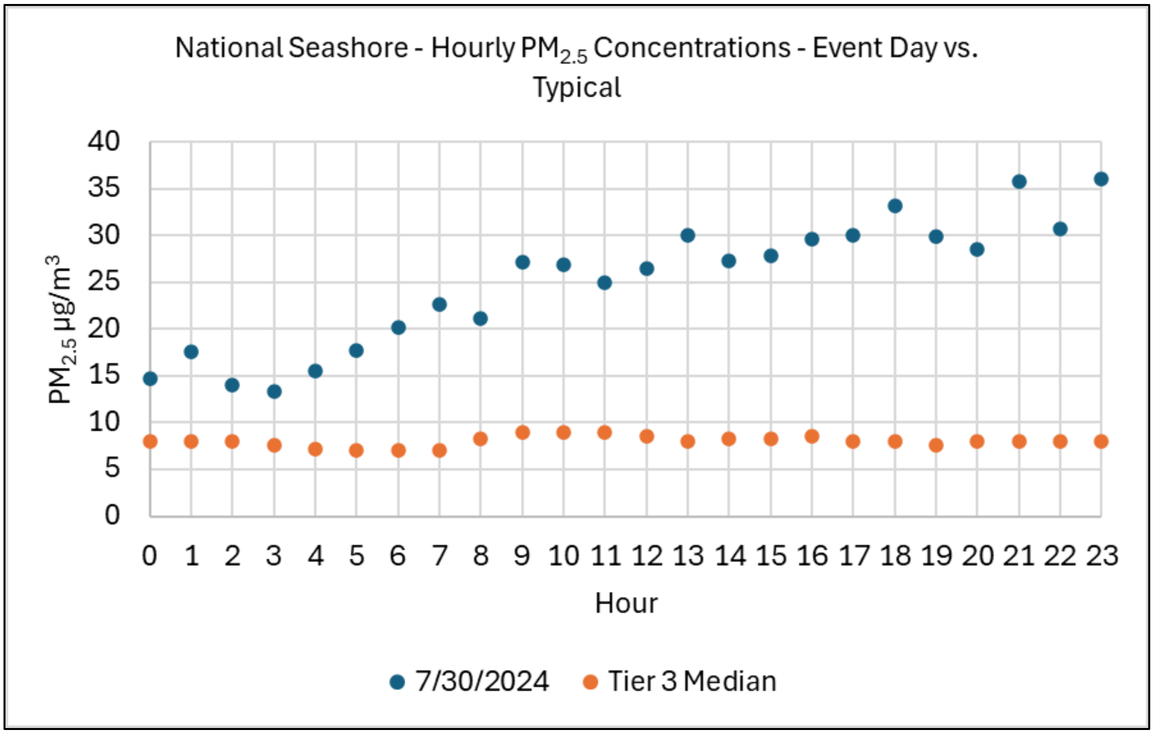


**Figure 3-137: Hourly $PM_{2.5}$ Concentrations for July 30, 2024, Compared to Typical Concentrations at the National Seashore Monitor**

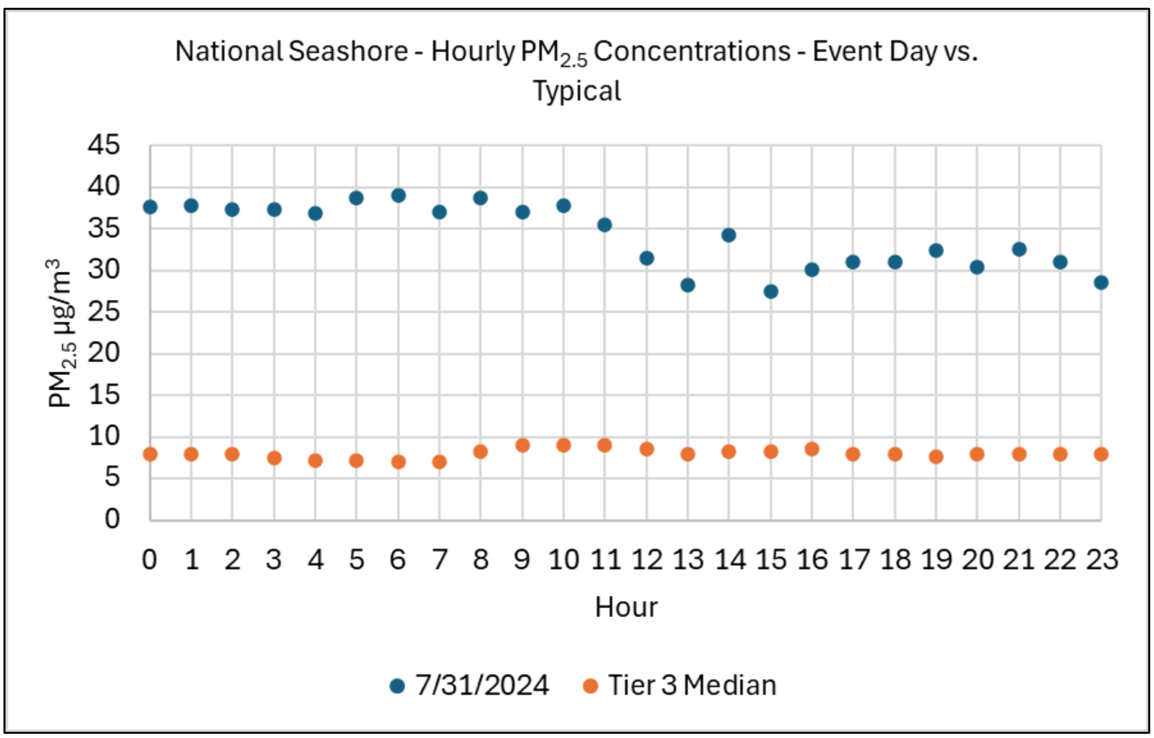


**Figure 3-138: Hourly $PM_{2.5}$ Concentrations on July 31, 2024, Compared to Typical Concentrations at the National Seashore Monitor**

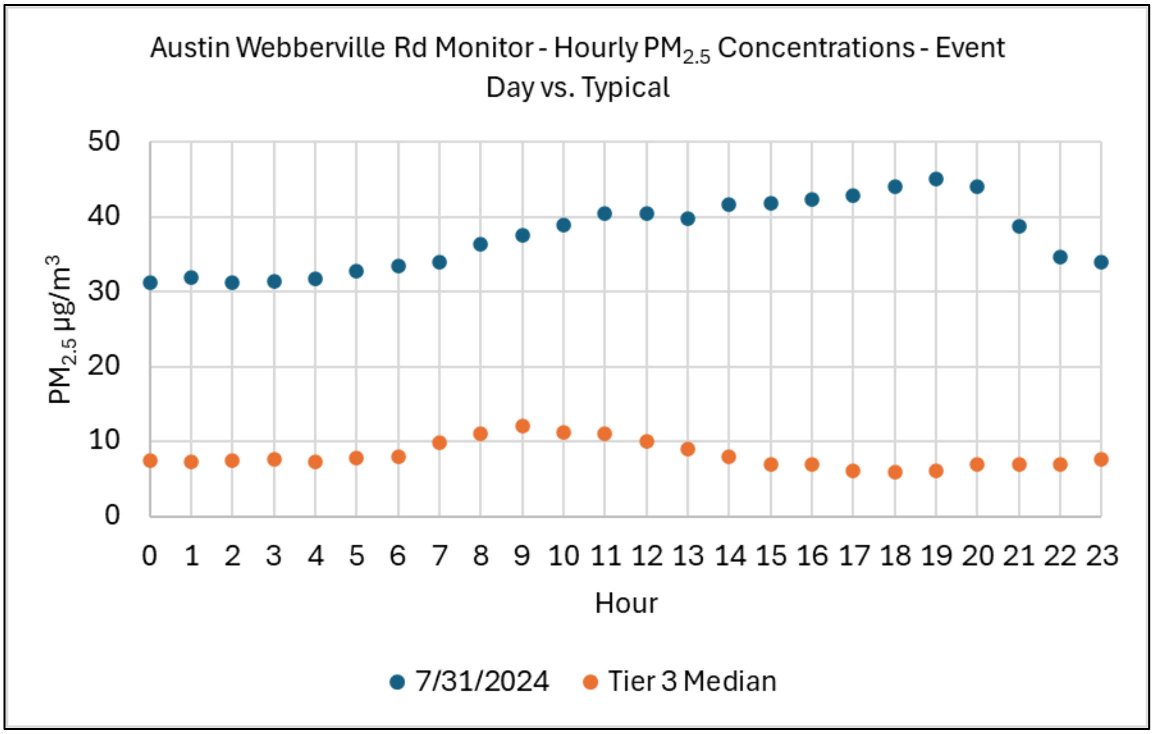


**Figure 3-139: Hourly $PM_{2.5}$ Concentrations on July 31, 2024, Compared to Typical Concentrations at the Webberville Monitor**

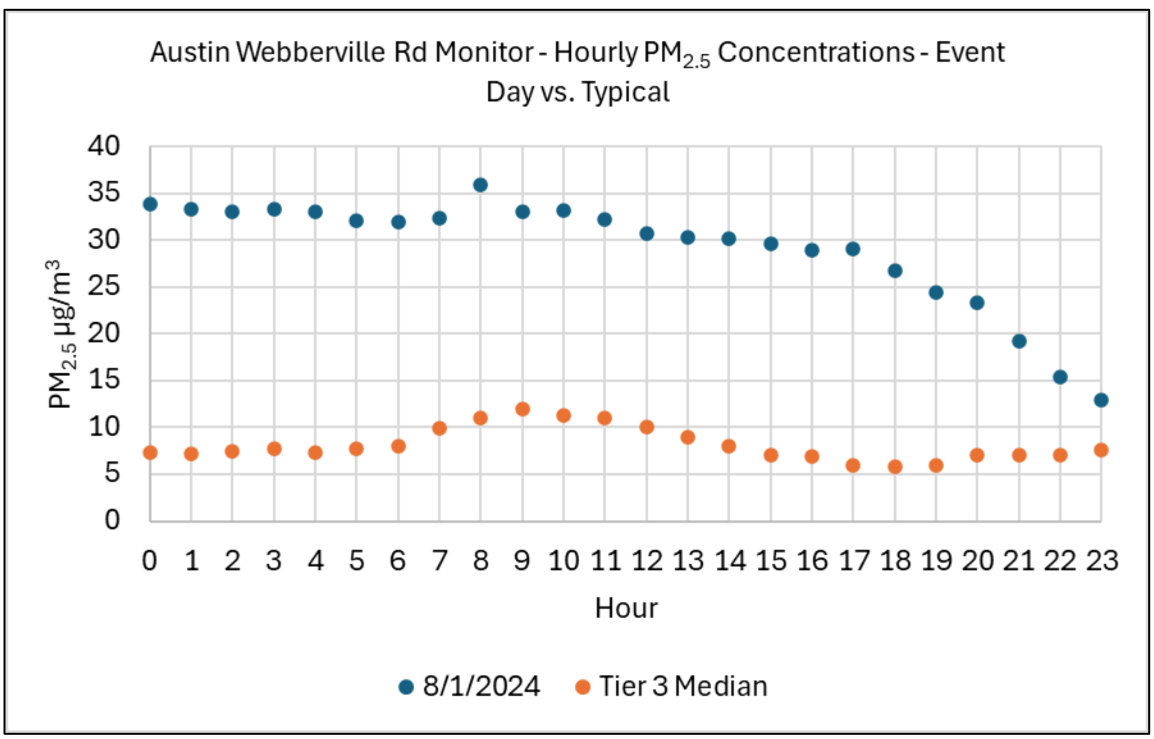


**Figure 3-140: Hourly $PM_{2.5}$ Concentrations on August 1, 2024, Compared to Typical Concentrations at the Webberville Monitor**

Figure 3-141: *AirNow Tech Aerosol Optical Depth (AOD) Map, with MODIS Terra and Aqua Satellite Layers on July 30, 2024*, and Figure 3-142: *AirNow Tech Aerosol Optical Depth (AOD)*

*Map, with MODIS Terra and Aqua Satellite Layers on August 1, 2024*, show high levels of aerosol optical depth over Texas.

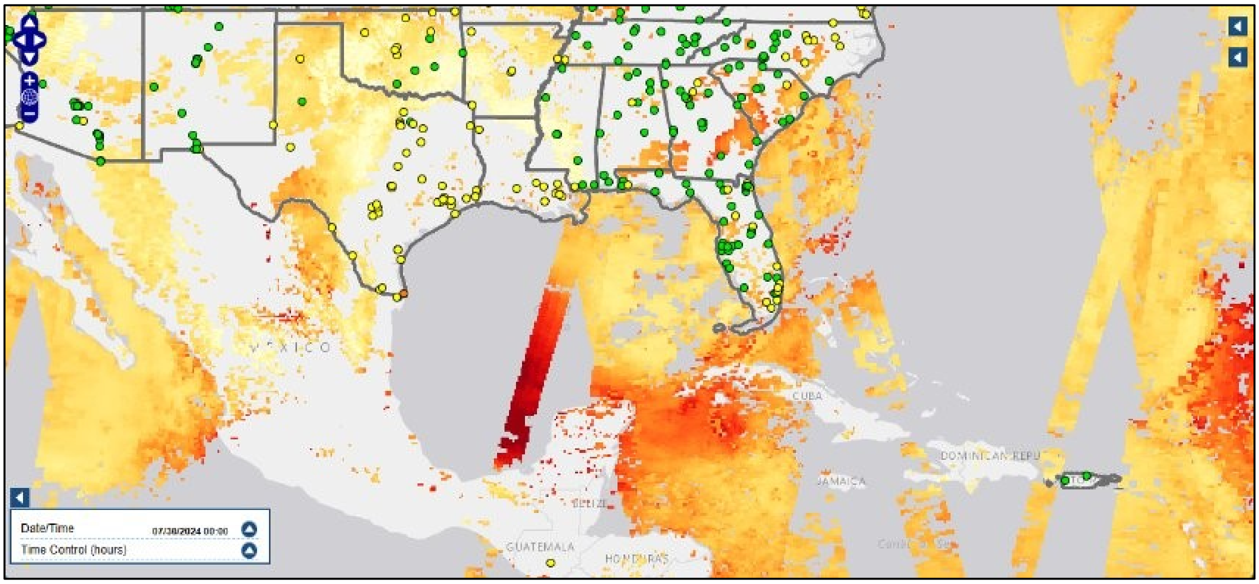


**Figure 3-141: AirNow Tech Aerosol Optical Depth (AOD) Map, with MODIS Terra and Aqua Satellite Layers on July 30, 2024**

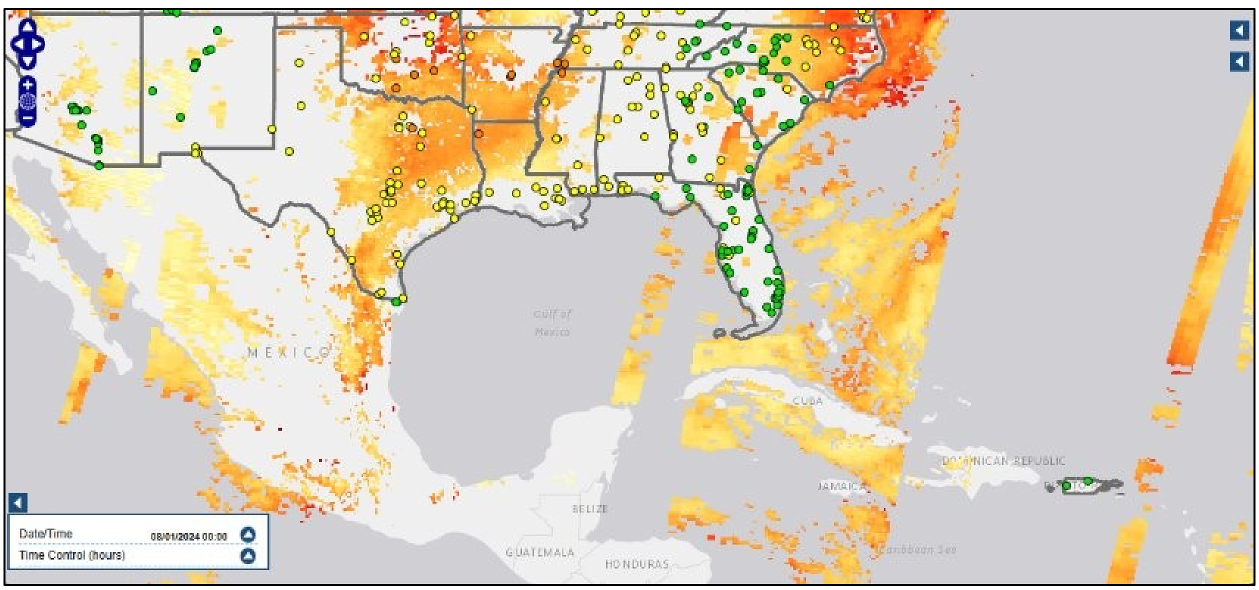


**Figure 3-142: AirNow Tech Aerosol Optical Depth (AOD) Map, with MODIS Terra and Aqua Satellite Layers on August 1, 2024**

Figure 3-143: *AirNow HYSPLIT Trajectories for National Seashore on July 30, 2024*, Figure 3-144: *AirNow HYSPLIT Trajectories for National Seashore on July 31, 2024*, *Figure 3-145: HYSPLIT Forward Trajectories on July 30, 2024*, and *Figure 3-146: HYSPLIT Forward Trajectories for August 1, 2024*, show back trajectories heading toward the Atlantic Ocean and forward trajectories from northern Africa heading toward South and Central Texas.

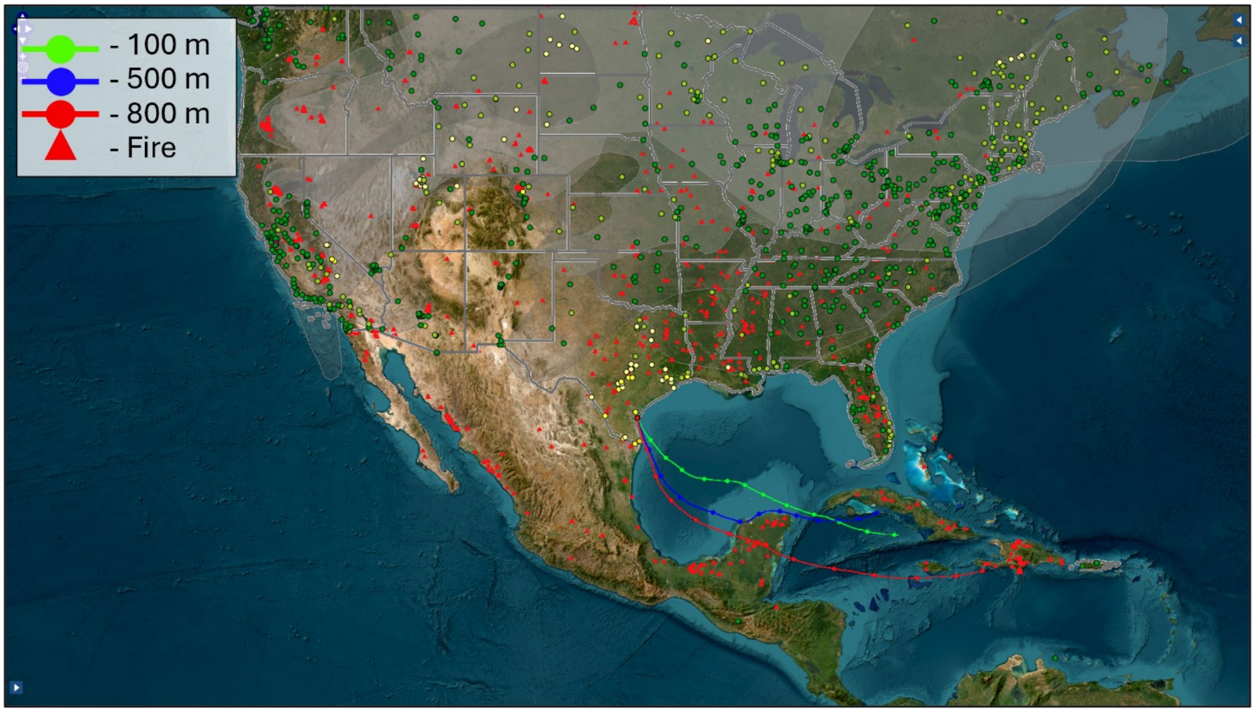

**Figure 3-143: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on July 30, 2024**

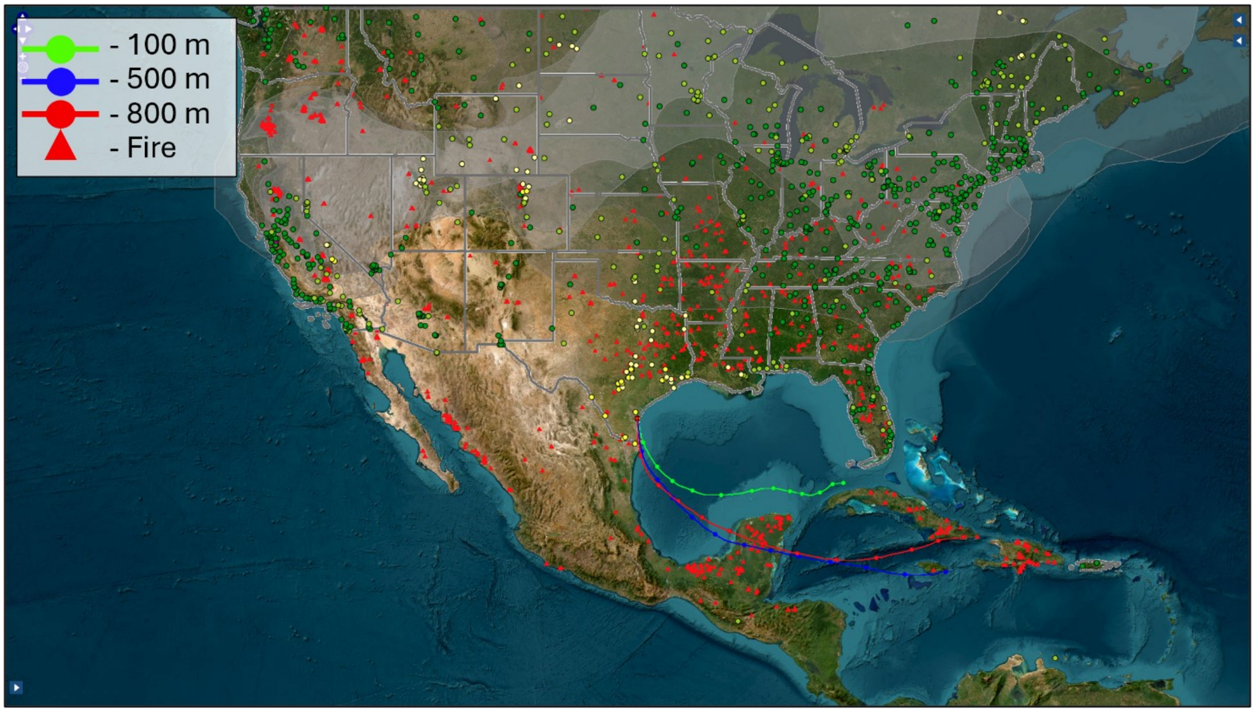

**Figure 3-144: AirNow Tech HYSPLIT 72-Hour Backward Trajectories Originating from the National Seashore Monitor on July 31, 2024**

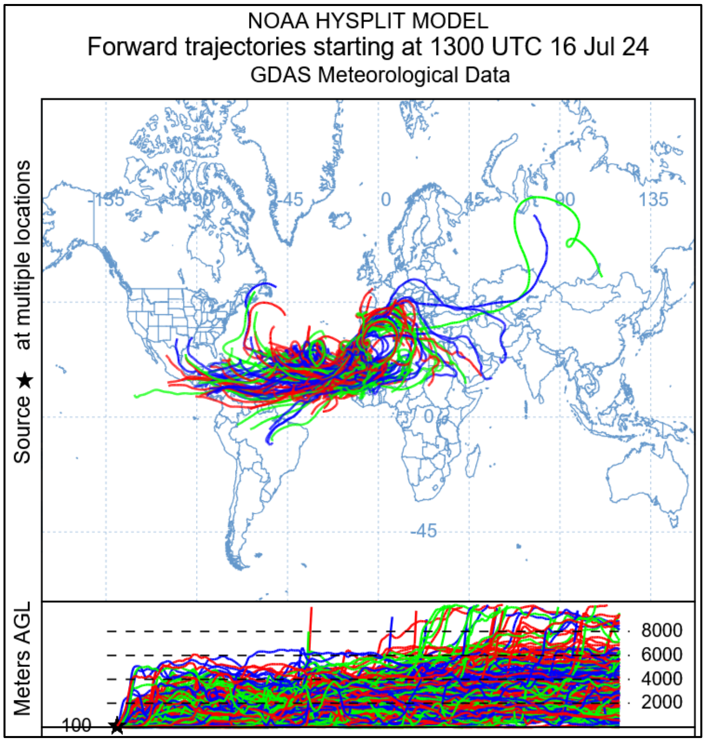


**Figure 3-145: NOAA HYSPLIT 14-Day Forward Trajectories Originating from the Saharan Desert, Starting on July 16, 2024**

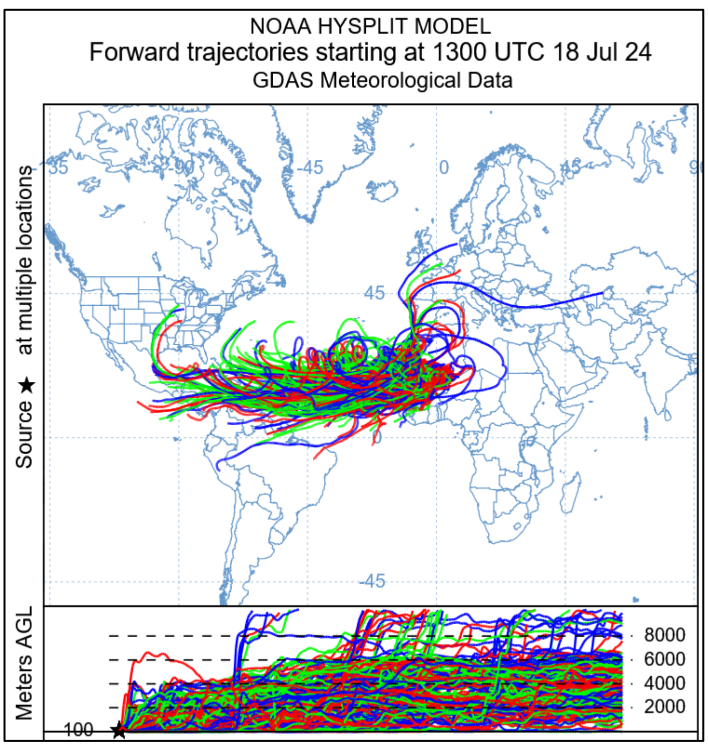


**Figure 3-146: NOAA HYSPLIT 14-Day Forward Trajectories Originating from the Saharan Desert, Starting on July 18, 2024**

## SECTION 4: NOT REASONABLY CONTROLLABLE OR NOT REASONABLY PREVENTABLE

### 4.1 OVERVIEW

This section satisfies the Exceptional Events Rule Requirements at 40 CFR §§50.14(c)(3)(iv)(A), 50.1(j), 50.14(c)(3)(iv)(D), and 50.14(b)(4): “The event was caused by a natural event; an exceptional event is one that is not reasonably controllable or preventable.”

### 4.2 NATURAL AND ANTHROPOGENIC SOURCE CONTRIBUTIONS

Stationary point source emissions data are collected annually from sites that meet the reporting requirements of 30 Texas Administrative Code (TAC) §101.10, and the emissions data are compiled in TCEQ’s State of Texas Environmental Electronic Reporting System (STARS). STARS fine particulate matter ($PM_{2.5}$) emissions data are presented for each county. Emissions for other sectors from the 2020 National Emissions Inventory (NEI) are presented for each county.[9]

The wind rose at each monitor is from the EPA *$PM_{2.5}$ Designations Mapping Tool.*[10] The wind rose shows the general wind direction and speed for each monitor during the period from 2021 to 2023. The circular format of the wind rose shows the direction the winds blew from and the length of each "spoke" around the circle shows how often the wind blew from that direction.[11]

#### 4.2.1 Harrison County

The Karnack monitor is located in Harrison County, in the city of Karnack, TX. The major point sources of $PM_{2.5}$ (as defined in 40 CFR §§51.165 and 51.166) are located in South Harrison County (Figure 4-1: *Point Sources in and around Harrison County, from 2023*); however, a majority of the $PM_{2.5}$ emissions are non-point, as shown in Table 4-1: *Emissions Inventory in Harrison County, from 2020*.

[9] https://www.epa.gov/air-emissions-inventories/2020-national-emissions-inventory-nei-data
[10] https://experience.arcgis.com/experience/a2ca272ce9fc4019a88ce35b863e2cab
[11] https://www.epa.gov/sites/default/files/2019-01/documents/how_to_read_a_wind_rose.pdf

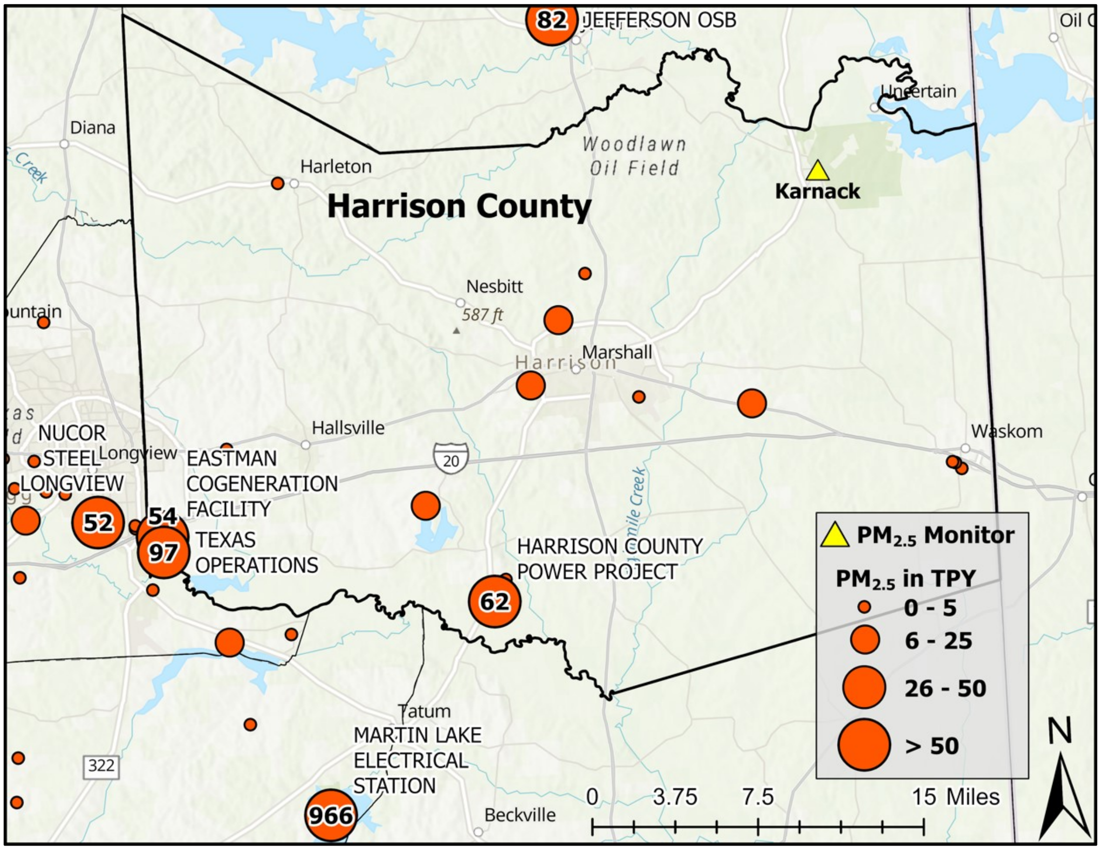


**Figure 4-1: Point Sources in and around Harrison County, from 2023**

**Table 4-1: Emissions Inventory in Harrison County, from 2020**

| Emissions Categories | Emissions (tons per year) |
|---|---:|
| On-road | 40.92 |
| Nonroad | 18.64 |
| Nonpoint | 1,031.62 |
| Point | 398.65 |
| Total | 1,489.82 |

Figure 4-2: *Wind Roses in Harrison County, from* 2021-2023 shows that at the Karnack monitor, a higher percentage of winds are coming from the south/southwest direction.

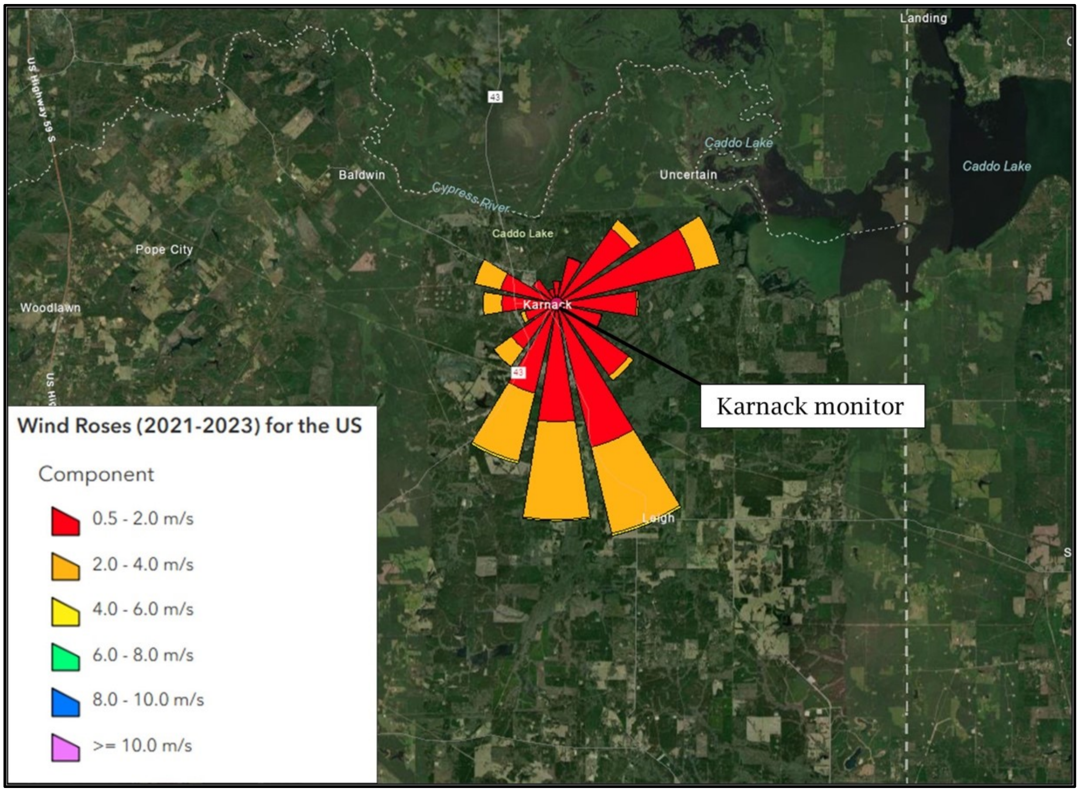


**Figure 4-2: Wind Roses in Harrison County, from 2021-2023**

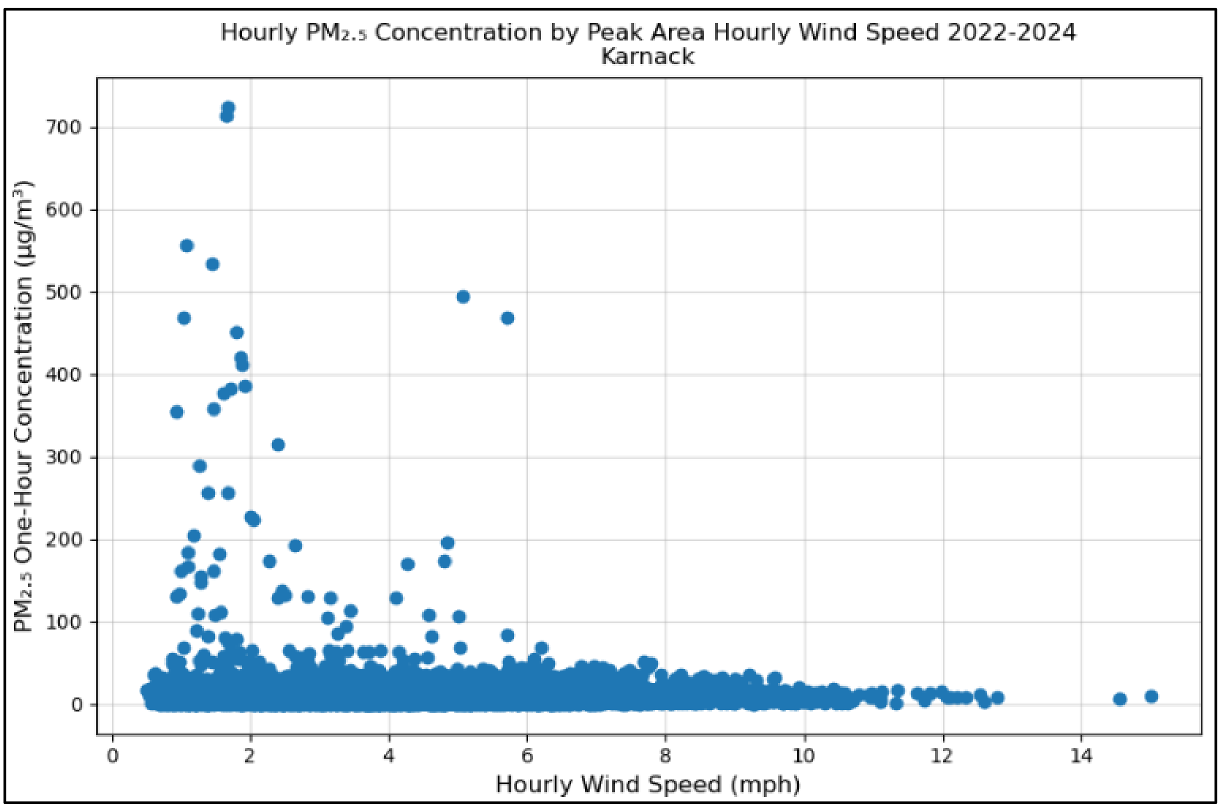


**Figure 4-3: Hourly Average Continuous $PM_{2.5}$ Concentrations at Karnack Monitor by Peak Area Hourly Wind Speed in Harrison County 2022, 2023, and 2024**

Figure 4-3: *Hourly Average Continuous $PM_{2.5}$ Concentrations at Karnack Monitor by Peak Area Hourly Wind Speed in Harrison County 2022,* 2023, and 2024 displays hourly wind speeds at the Karnack monitor plotted against $PM_{2.5}$ concentrations at the same monitor. The pattern in Figure 4-3 shows that the highest $PM_{2.5}$ concentrations were recorded when hourly wind speeds were relatively low. This pattern is believed to be due to the fact that $PM_{2.5}$, due to its small size, can be transported great distances where local wind conditions are less of a factor than wind conditions at the point from which the $PM_{2.5}$ was initially entrained in the air.

### 4.2.2 Travis County

The City of Austin is located in Travis County, and the Webberville monitor is located in southwest Austin. Most point sources are located in the eastern part of the county, as shown in Figure 4-4: *Point Sources in and around Travis County, from 2023*.

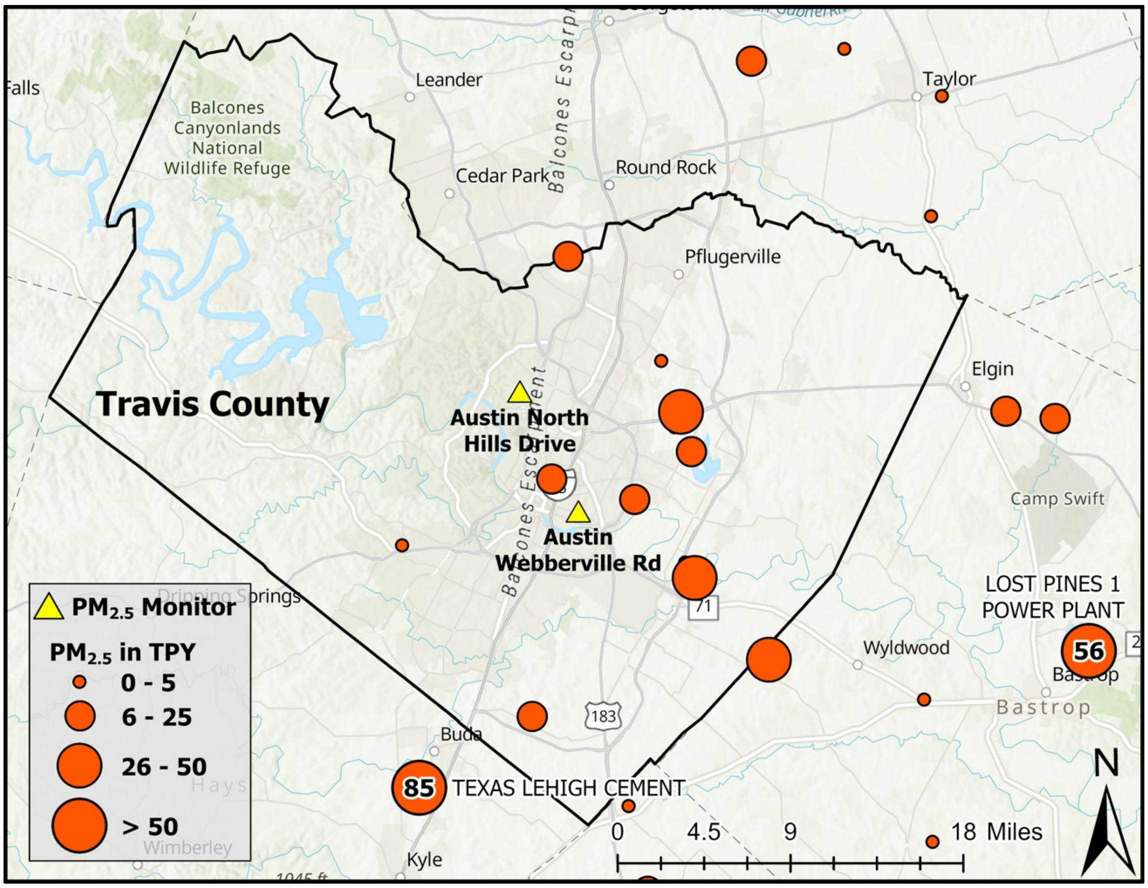

**Figure 4-4: Point Sources in and around Travis County, from 2023**

The majority of $PM_{2.5}$ emissions in Travis County come from non-point sources (Table 4-2: *Emissions Inventory in Travis County, from 2020*). The majority of the winds at the monitor are southerly (Figure 4-5: *Wind Roses in Harrison County, from 2021-2023*).

**Table 4-2: Emissions Inventory in Travis County, from 2020**

| Emissions Categories | Emissions (tons per year) |
|---|---|
| On-road | 187.10 |
| Nonroad | 250.82 |

| Emissions Categories | Emissions (tons per year) |
|---|---:|
| Nonpoint | 3,652.19 |
| Point | 165.86 |
| Total | 4,255.97 |

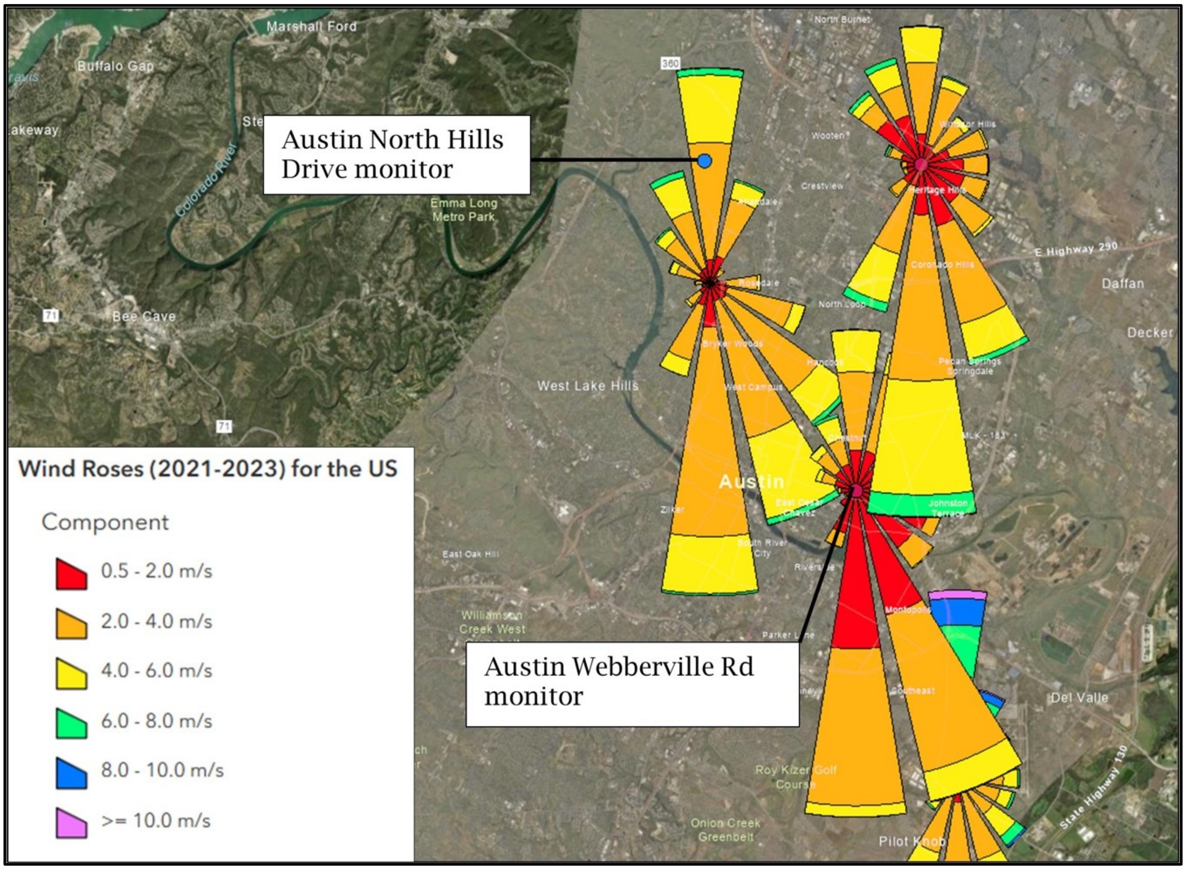


**Figure 4-5: Wind Roses in Harrison County, from 2021-2023**

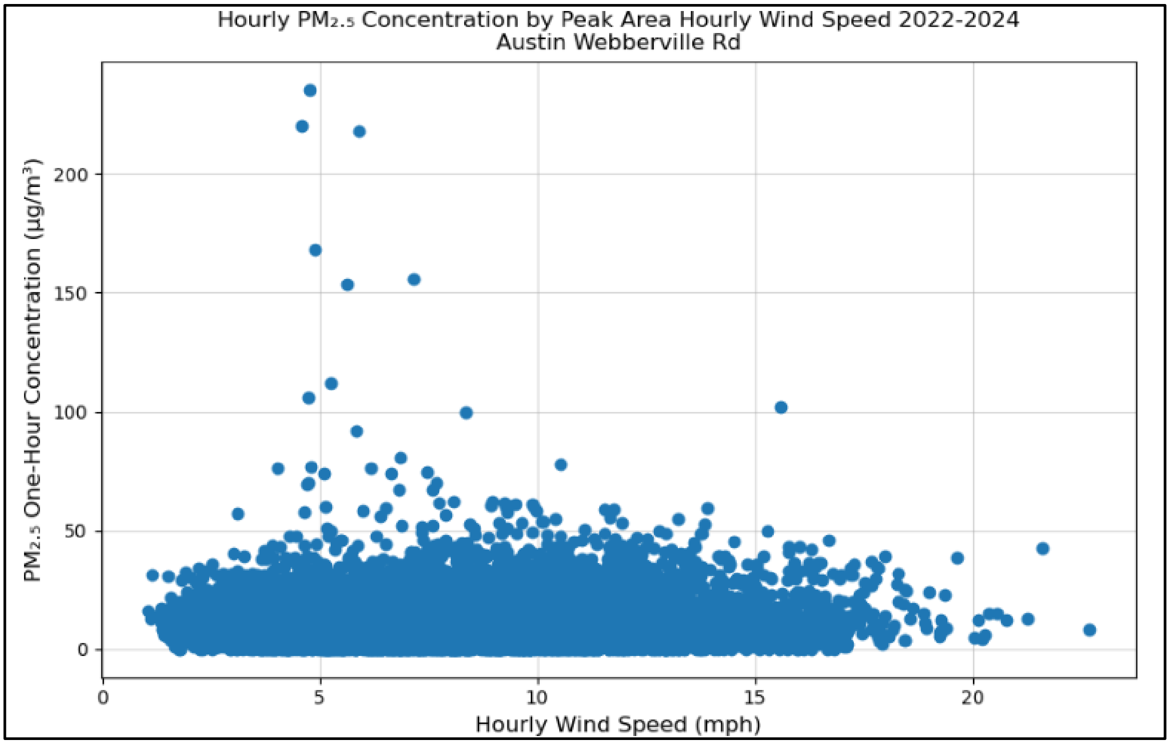


**Figure 4-6: Hourly Average Continuous $PM_{2.5}$ Concentrations at Webberville Monitor by Peak Area Hourly Wind Speed in Travis County 2022, 2023, and 2024**

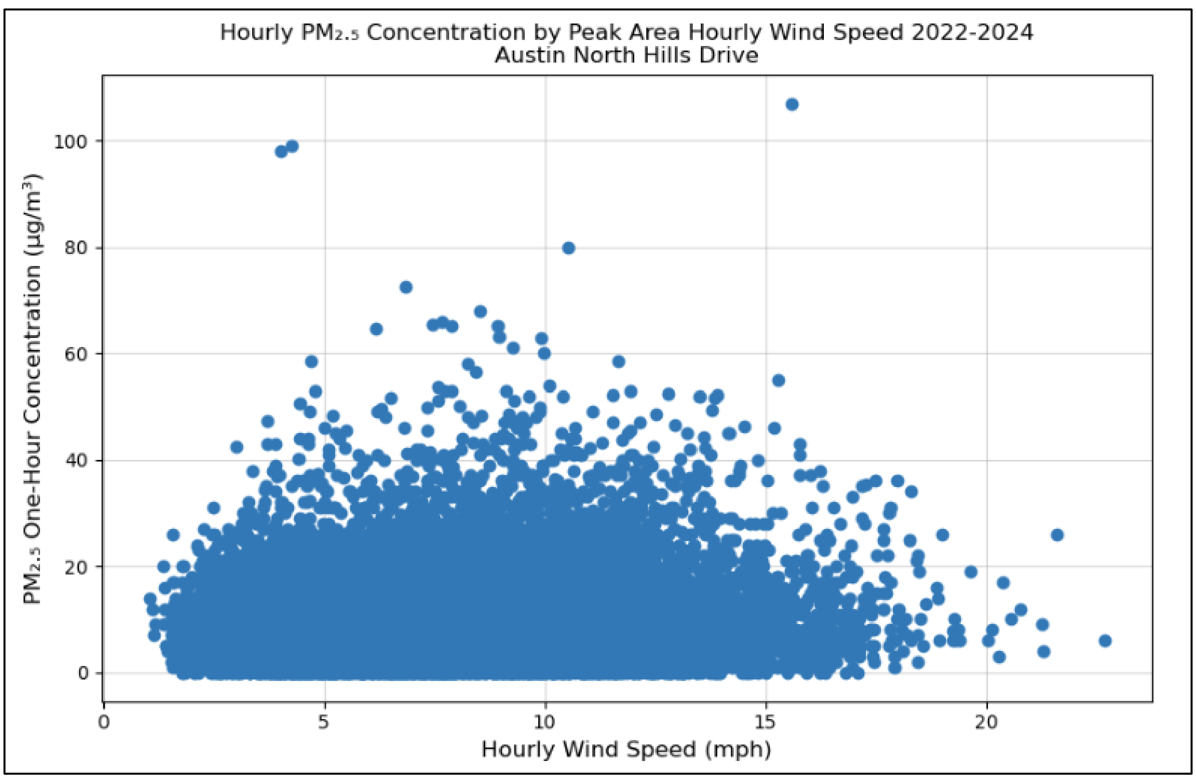


**Figure 4-7: Hourly Average Continuous $PM_{2.5}$ Concentrations at North Hills Monitor by Peak Area Hourly Wind Speed in Travis County for 2022, 2023, and 2024**

Figure 4-6: *Hourly Average Continuous $PM_{2.5}$ Concentrations at Webberville Monitor by Peak Area Hourly Wind Speed in Travis County 2022, 2023, and 2024* displays hourly wind speeds at the Webberville monitor plotted against $PM_{2.5}$ concentrations. There is no definitive observable pattern, and this is due to the fact that $PM_{2.5}$ can be transported great distances where local wind conditions are less of a factor than wind conditions at the point from which the $PM_{2.5}$ was initially entrained in the air.

### 4.2.3 Kleberg County

The National Seashore monitor is located on Padre Island in east Kleberg County. There are no major point sources of $PM_{2.5}$ in the county, and the closest major source is in Nueces County to the north (Figure 4-8: *Point Sources in and around Kleberg County, from 2023*). The majority of emissions in this county are from nonpoint sources, as shown in Table 4-3: *Emissions Inventory in Kleberg County, from 2020*.

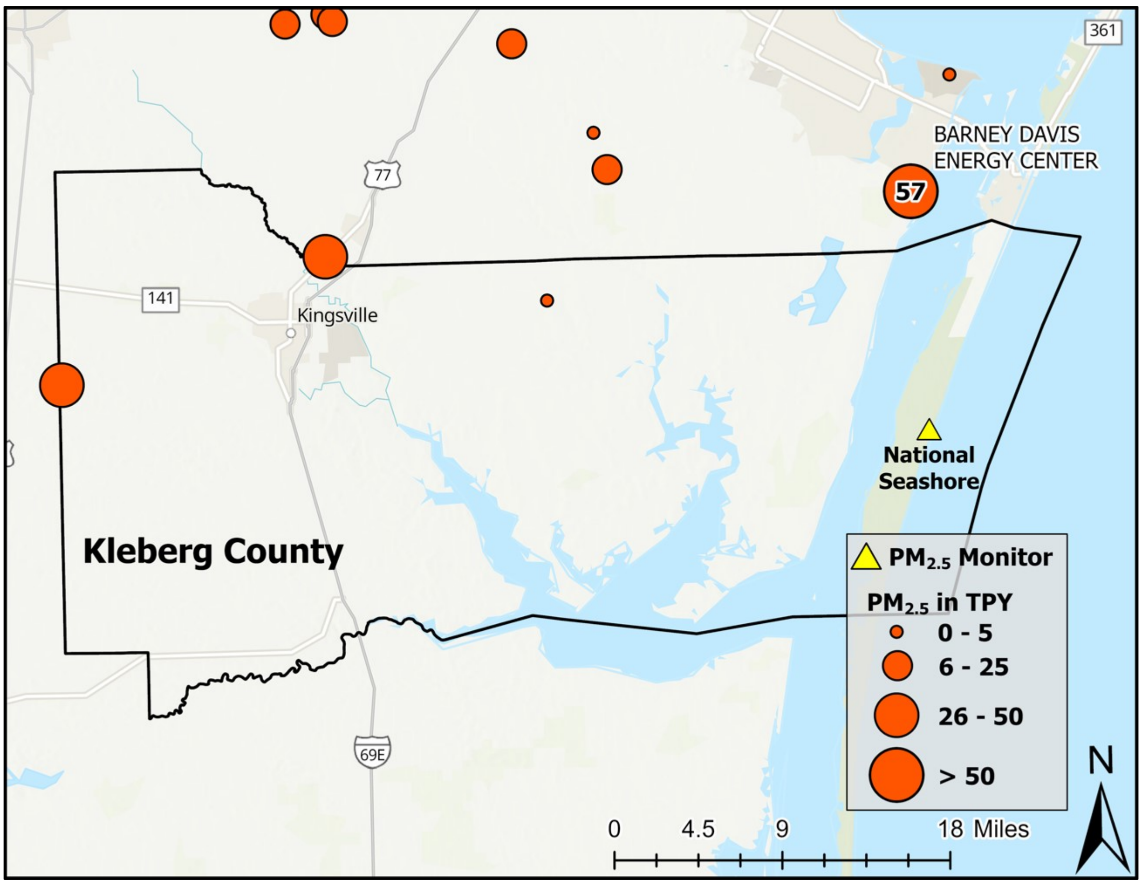


**Figure 4-8: Point Sources in and around Kleberg County, from 2023**

**Table 4-3: Emissions Inventory in Kleberg County, from 2020**

| Emissions Categories | Emissions (tons per year) |
|---|---|
| On-road | 9.03 |
| Nonroad | 11.40 |
| Nonpoint | 1,790.62 |
| Point | 38.14 |

| Emissions Categories | Emissions (tons per year) |
|---|---|
| Total | 1,849.19 |

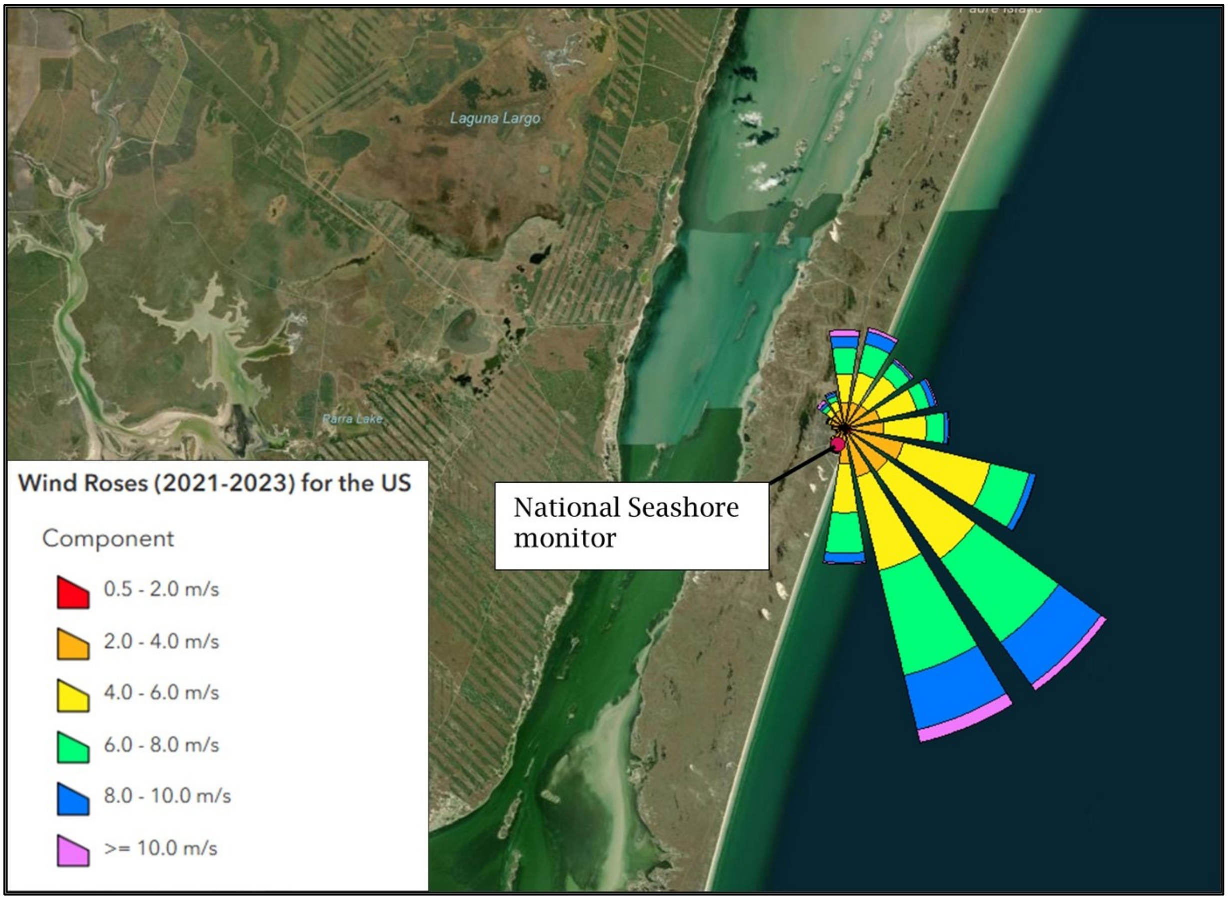


**Figure 4-9: Wind Roses in Kleberg County, from 2021-2023**

Winds at the National Seashore monitor are mainly from the southeast, as shown in Figure 4-9: *Wind Roses in Kleberg County, from 2021-2023*. Figure 4-10: *Hourly Average Continuous $PM_{2.5}$ Concentrations at National Seashore Monitor by Peak Area Hourly Wind Speed in Kleberg County 2022, 2023, and 2024* displays hourly wind speeds at the National Seashore monitor plotted against $PM_{2.5}$ concentrations at the same monitor. There is no definitive pattern in Figure 4-10 and this is due to the fact that $PM_{2.5}$ can be transported great distances where local wind conditions are less of a factor than wind conditions at the point from which the $PM_{2.5}$ was initially entrained in the air.

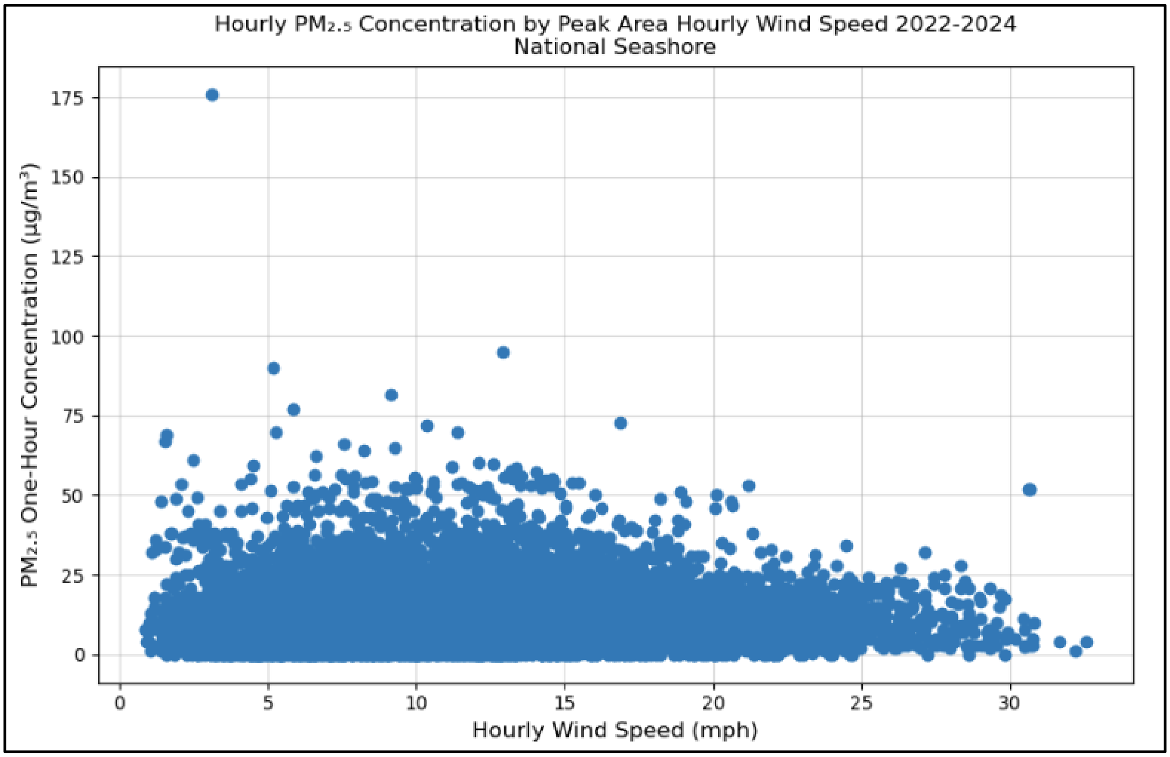


**Figure 4-10: Hourly Average Continuous $PM_{2.5}$ Concentrations at National Seashore Monitor by Peak Area Hourly Wind Speed in Kleberg County 2022, 2023, and 2024**

## 4.3 ATTAINMENT STATUS AND CONTROL MEASURES

Harrison, Travis, and Kleberg Counties are currently designated as attainment for the 2012 primary annual $PM_{2.5}$ standard of 12.0 µg/m³. In February 2024), EPA lowered the primary annual standard to 9.0 µg/m³, and 2024 design values show that $PM_{2.5}$ concentrations in the aforementioned counties are above the revised standard. In this document, TCEQ demonstrates that the $PM_{2.5}$ concentrations at monitors on dates listed in Table 1-1 were caused by exceptional events and requests that these dates be excluded from regulatory decisions for the 2024 annual $PM_{2.5}$ NAAQS.

As a part of the state implementation plan (SIP) strategy, Texas has established statewide rules to attain or maintain the National Ambient Air Quality Standards for particulate matter (PM). Title 30 TAC §111, Subchapter A includes statewide regulations for visible emissions and PM. [12] These regulations contain control requirements that apply to various sources of PM emissions and monitoring, testing, and recordkeeping requirements for affected sources. Title 30 TAC §111, Subchapter B is a statewide regulation that addresses outdoor burning and is applicable to particulate matter control. [13]

## 4.4 PRESCRIBED FIRES AND SMOKE MANAGEMENT PLANS

The Texas A&M Forest Service (TFS, formally called Texas Forest Service) coordinates fire and smoke management issues in Texas to address basic smoke management practices for prescribed fire used for agricultural and wildland vegetation management purposes and smoke

[12] https://texreg.sos.state.tx.us/public/readtac$ext.ViewTAC?tac_view=5&ti=30&pt=1&ch=111&sch=A
[13] https://texreg.sos.state.tx.us/public/readtac$ext.ViewTAC?tac_view=5&ti=30&pt=1&ch=111&sch=B&rl=Y

management programs pursuant to the requirements under the Regional Haze Rule 40 CFR §51.308(f)(2)(iv)(D).[14] The 34th Texas Legislature created the TFS in 1915. The legal mandate of the TFS includes the responsibility to "assume direction of all forest interests and all matters pertaining to forestry within the jurisdiction of the state." The TFS has developed a voluntary approach called the Texas Forest Service Smoke Management System, under which all land managers in Texas, including the National Park Service, inform the TFS before performing prescribed burns.

The Regional Haze Rule allows for states to have smoke management programs that are comparable to smoke management plans (SMP) without being certified as SMPs. The following list is documentation that Texas has a structure in place, with rules, communication systems, and data collection to help reduce particulate matter, which reduces visibility. The following are documents, rules, memorandums of understanding, etc., that help establish that Texas has a working smoke management program to help reduce smoke and fires throughout the state. This list is not exhaustive and is only a sample. The documents are updated periodically.

- Texas Forest Service (TFS), 2023. Texas Wildfire Protection Plan.[15]
- TFS, 2018. Texas A&M Forest Service Smoke Management Plan.[16]
- TCEQ, 2015. Outdoor Burning in Texas, publication number: RG-049.[17]
- Texas Administrative Code (TAC), Title 30, Environmental Quality, Part 1, Texas Commission on Environmental Quality, Chapter 111, Control of Air Pollution from Visible Emissions and Particulate Matter, Subchapter B, Outdoor Burning.[18]
- Texas Parks and Wildlife Department, 2015. General Plan for Prescribed Burning on Texas Parks and Wildlife Department Lands.[19]
- Master Cooperative Wildland Fire Management and Stafford Act Response Agreement with U.S. Forest Service, National Park Service, U.S. Fish & Wildlife Service, Bureau of Indian Affairs, Texas Forest Service, and Texas Parks and Wildlife Department, 2015.[20]

### 4.5 FIRES IN MEXICO/CENTRAL AMERICA AND SAHARAN DUST

Section 40 CFR §50.14 (a)(8)(vii) provides that a state would not be required to provide case-specific justification to support the not reasonably controllable or preventable portion of the rule when the emissions-generating event was outside the state. Specifically, Section 40 CFR §50.14 (a)(8)(vii) states:

> *The Administrator shall not require a State to provide case-specific justification to support the not reasonably controllable or preventable criterion for emissions-generating activity that occurs outside of the State's jurisdictional boundaries within which the concentration at issue was monitored.*

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[14] https://tfsweb.tamu.edu/
[15] https://tfsweb.tamu.edu/uploadedFiles/TFSMain/Wildfires_and_Disasters/Contact_Us(3)/Texas%20Wildfire%20Protection%20Plan_May%202023%20Revision.pdf
[16] https://tfsweb.tamu.edu/uploadedFiles/TFS_Main/Manage_Forests_and_Land/Prescribed_Fires/TFS%20SMP.pdf
[17] https://www.tceq.texas.gov/downloads/publications/rg/outdoor-burning-in-texas-rg-49.pdf
[18] https://texreg.sos.state.tx.us/public/readtac$ext.ViewTAC?tac_view=5&ti=30&pt=1&ch=111&sch=B&rl=Y
[19] https://tpwd.texas.gov/publications/pwdpubs/media/pwd_lf_w7000_1818_general_plan_for_burning_on_tpwd_lands.pdf
[20] https://gacc.nifc.gov/swcc/management_admin/incident_business/docs/25.Texas%20Master%20Agreement.pdf

## SECTION 5: HUMAN ACTIVITY UNLIKELY TO RECUR AT A PARTICULAR LOCATION OR NATURAL EVENT

### 5.1 OVERVIEW

This section satisfies the Exceptional Events Rule Requirement at 40 CFR §50.14(c)(3)(iv)(E): "A demonstration that the event was a human activity that is unlikely to recur at a particular location or was a natural event."

### 5.2 AFRICAN DUST – NATURAL EVENT

Based on the documentation provided in Section 3 of this demonstration, the event qualifies as a natural event due to dust originating from the Sahara Desert, which is relatively undisturbed by human activity and has commonly occurring dust storms.

EPA generally considers the emissions of $PM_{2.5}$ from dust events to meet the regulatory definition of a natural event under 40 CFR §50.1(k), defined as one 'in which human activity plays little or no direct causal role.'

Saharan dust impacts monitors in Texas every year, mainly in the summer. The three to six episodes per year are typically intense and characterized by high incoming background levels that last one to three days or more. Satellite imagery provides good visual evidence of African dust moving across the Atlantic Ocean, through the Caribbean, and into the Gulf of Mexico.

Current NASA Worldview satellite imagery of dust surface mass concentration layers created from time-averaged 2-dimensional mean data collections from July 2021, 2022, and 2023, present an annual trend of dust being transported from west Africa through the Caribbean and into Texas (Figure 5-1: *July 2021 Monthly Average Dust Surface Mass Concentration (MERRA-2)*, Figure 5-2: *July 2022 Monthly Average Dust Surface Mass Concentration (MERRA-2)*, and Figure 5-3: *July 2023 Monthly Average Dust Surface Mass Concentration (MERRA-2)*).

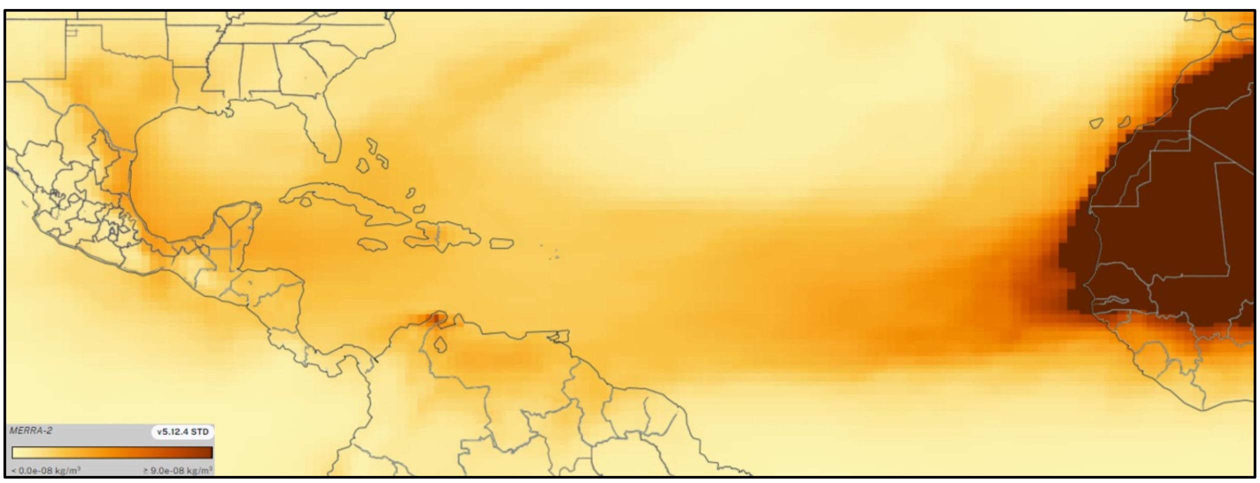


**Figure 5-1: July 2021 Monthly Average Dust Surface Mass Concentration (MERRA-2)**

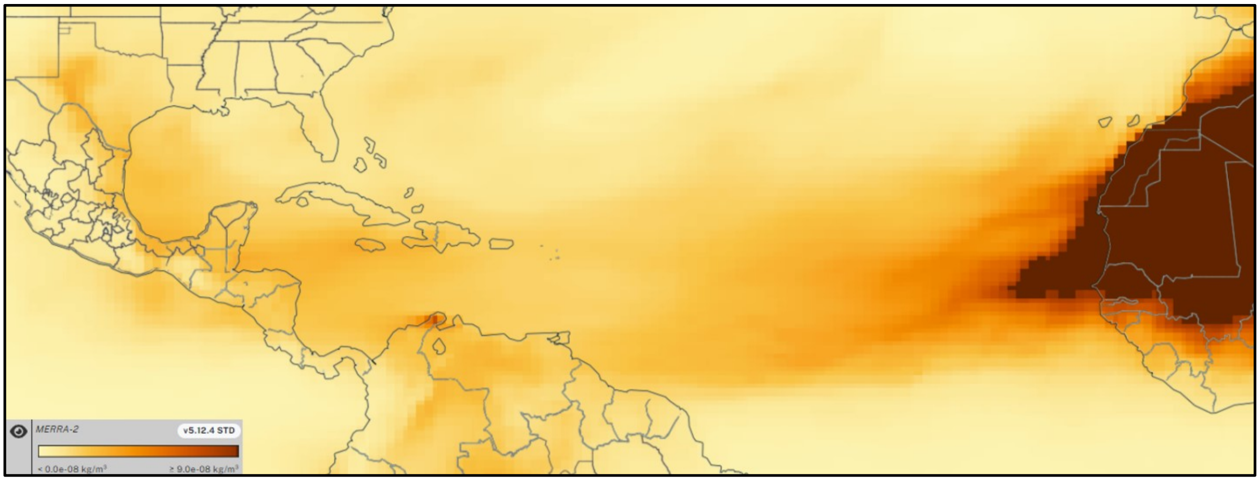


**Figure 5-2: July 2022 Monthly Average Dust Surface Mass Concentration (MERRA-2)**

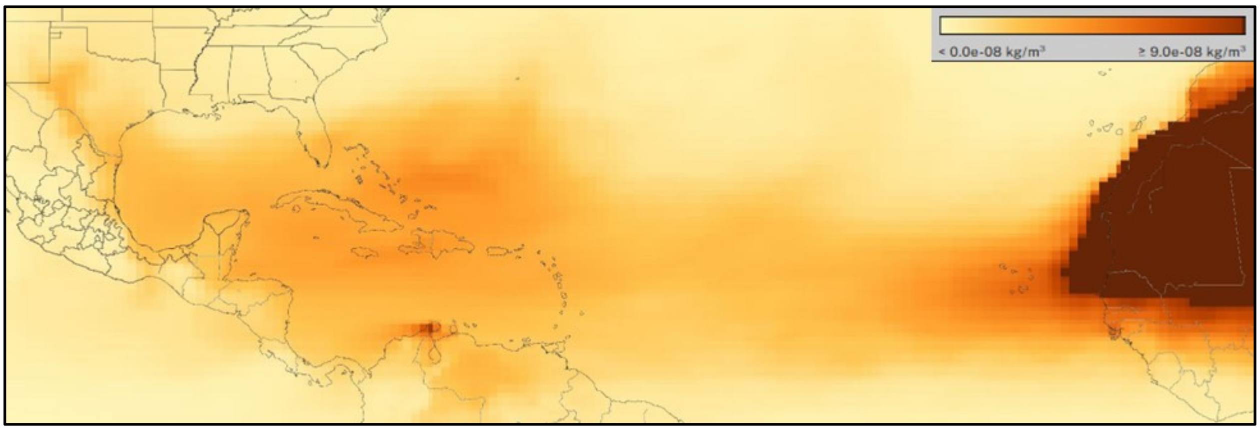


**Figure 5-3: July 2023 Monthly Average Dust Surface Mass Concentration (MERRA-2)**

## 5.3 PRESCRIBED FIRES – HUMAN ACTIVITY UNLIKELY TO RECUR AT A PARTICULAR LOCATION

Prescribed fires are recognized as being caused by human activity, and therefore must satisfy the 'human activity unlikely to recur at a particular location' portion of the rule. Recurrence for prescribed fires is defined by either "the natural fire return interval or the prescribed fire frequency needed to establish, restore and/or maintain a sustainable and resilient wildland ecosystem contained in a multi-year land or resource management plan with a stated objective to establish, restore and/or maintain a sustainable and resilient wildland ecosystem and/or to preserve endangered or threatened species through a program of prescribed fire." Thus, the recurrence frequency for prescribed fire is specific to the ecosystem and resource needs of the affected area.

The Texas A&M Forest Service coordinates prescribed fires and establishes smoke management plans for the state, as described in Section 4.4. Smoke from prescribed fires in other states may impact Texas monitors as well. The prescribed fires impacting monitors in Texas occurred in Texas and Louisiana. Any prescribed fires occurring outside the State of Texas were not reasonably controllable or preventable by the State of Texas and are essentially treated as wildfires in this demonstration. The State of Louisiana maintains robust programs aimed at responding to wildfires and preventing future ones. The Louisiana Department of Agriculture and Forestry maintains information for prescribed burning on its Prescribed Burning webpage.[21]

Based on the documentation provided in Section 3 of this submittal, the prescribed fire events satisfied the 'human activity unlikely to recur at a particular location' criterion by describing the transitory nature of the fire smoke and the high $PM_{2.5}$ concentration on event days.

### 5.4 HIGH WINDS – NATURAL EVENT

High wind dust events are considered to be natural events in cases where windblown dust is entirely from natural undisturbed lands in the area or where all anthropogenic sources are reasonably controlled (40 CFR §50.14(b)(5)(ii)). An event involving windblown dust solely from natural undisturbed landscapes is considered a natural event.

Based on the documentation provided in Section 3 of this submittal, the high wind events qualify as a natural event. The exceedances of $PM_{2.5}$ associated with the high wind events listed in Table 1-1 meet the regulatory definition of a natural event at 40 CFR §50.14(b)(8). These events transported windblown dust from natural lands in West Texas and, accordingly, TCEQ has demonstrated that the event is a natural event and may be considered for treatment as an exceptional event.

### 5.5 FIRES IN MEXICO/CENTRAL AMERICA – HUMAN ACTIVITY UNLIKELY TO RECUR AT A PARTICULAR LOCATION

A recent report titled "*Fires in Mexico as Exceptional Events: Documentation and Implications*" provided evidence that the vast majority of the fires in Mexico are not caused by agricultural burning, and that they do not reoccur at the same location.[22] The evidence includes statistics on the source of fires from the Mexican government and other sources.

A majority of the observed fires are forest fires or burns performed to clear land for development, and these are also not expected to recur at a particular location. Once the forest is burned at a specific location, the biomass is consumed, and the land is not prime for additional fires in the following years. The Global Forest Watch website shows that areas with highest rates of tree loss due to forest fires occur along the east coast of Mexico. Mexican fires show seasonality that follows known climatology with a dry season, typically in the period of January to May, that affects Mexico and Central America. This dry season favors conditions for starting of wildfires.

The report suggests that most of the fires and smoke from fire in Mexico during the dry season should be considered non-recuring and thus should be considered exceptional events as it satisfies that is an event caused by human activity that is unlikely to recur at a particular location or a natural event.

TCEQ downloaded data on the number of reported fires in 2022, 2023, and 2024 and possible causes of these fires from the Gobierno de Mexico's "*Concentrado Nacional de Incendios Forestales*" (Government of Mexico's National Concentration of Forest Fires) webpage.[23] In 2022, a total of 6,719 instances of fires were reported with 15 unique possible causes: Camp fires, Unknown, Intentional, Smokers, Transportation, Agricultural activities, Celebrations and Rituals, Hunters, Cattle Activities, Burning Trash, Natural, Other productive activities, Forest

[21] https://www.ldaf.la.gov/land/fire/prescribed-burning
[22] https://www.tceq.texas.gov/downloads/air-quality/sip/pm/ramboll_mexicanfires.pdf
[23] https://monitor_incendios.cnf.gob.mx/incendios_tarjeta_semanal, accessed on January 27, 2025.

Waste, Road Clearing, and Illegal Activities. Of the 6,719 fires in 2022, 2,198 (33%) fires occurred in protected natural areas and are unlikely to recur. In 2023 and 2024 a total of 7,611 and 8,002 instances of fires, respectively, were reported with 14 unique possible causes: Camp fires, Unknown, Intentional, Smokers, Transportation, Agricultural activities, Celebrations and Rituals, Hunters, Cattle Activities, Burning Trash, Natural, Other productive activities, Forest Waste, and Road Clearing. Of the 7,611 fires in 2023, 2,334 (31%) fires occurred in protected natural areas and are unlikely to recur. Of the 8,002 fires in 2024, 2,590 (32%) fires occurred in protected natural areas and are unlikely to recur.

Figure 5-4: *Map of Forest Fires in Mexico in 2022* is a map of all the instances of forest fires reported in 2022. Figure 5-5: *Fires in Mexico in 2022 classified as unlikely or likely to recur based on possible causes* shows that 45% of fires that occurred in 2022 are unlikely to recur based on the possible causes provided and covered a surface area of 286,854.66 hectares where fires are unlikely to recur.[24] Figure 5-6: *Map of Forest Fires in Mexico in 2023* is a map of all the instances of forest fires reported in 2023. Figure 5-7: *Fires in Mexico in 2023 classified as unlikely or likely to recur based on possible causes* shows that 49% of fires that occurred in 2023 are unlikely to recur based on the possible causes provided and covered a surface area of 405,785.69 hectares where fires are unlikely to recur.[25] Figure 5-8: *Map of Forest Fires in Mexico in 2024* is a map of all the instances of forest fires reported in 2024. Figure 5-9: *Fires in Mexico in 2024 classified as unlikely or likely to recur based on possible causes* shows that 35% of fires that occurred in 2024 are unlikely to recur based on the possible causes provided and covered a surface area of 346,504.05 hectares where fires are unlikely to recur.[24] It should be noted that the data available on the website is only for forest fires and is therefore only a subset of fires that happened in 2022, 2023, and 2024.

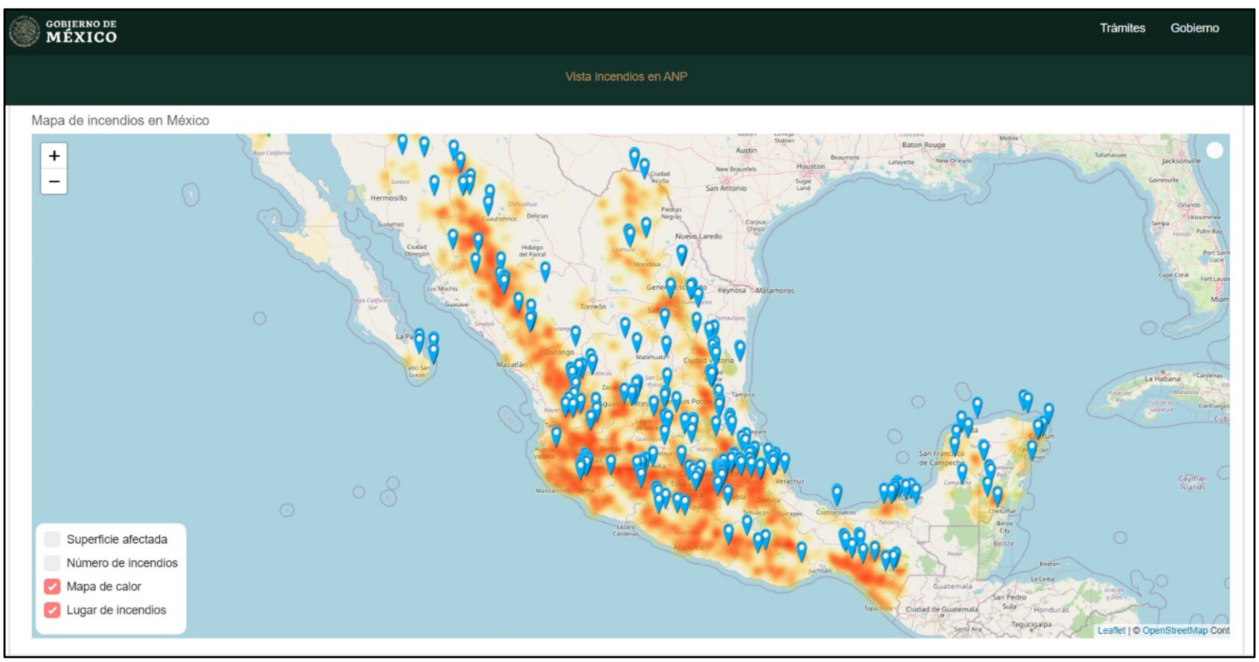


**Figure 5-4: Map of Forest Fires in Mexico in 2022**

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[24] TCEQ classified forest fires that had possible causes of Camp fires, Intentional, Smokers, Hunters, Natural, Forest Waste, and Illegal Activities as unlikely to recur.
[25] TCEQ classified forest fires that had possible causes of Camp fires, Intentional, Smokers, Hunters, Natural, and Forest Waste as unlikely to recur.

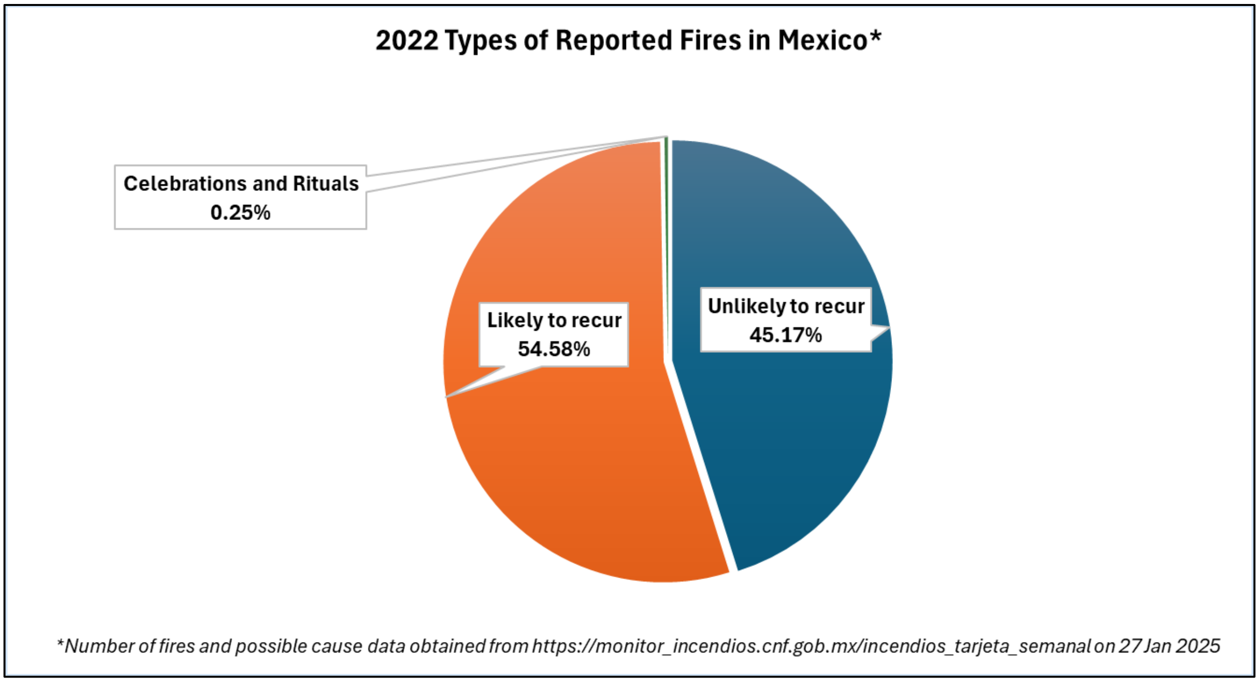


**Figure 5-5: Fires in Mexico in 2022 classified as unlikely or likely to recur based on possible causes**

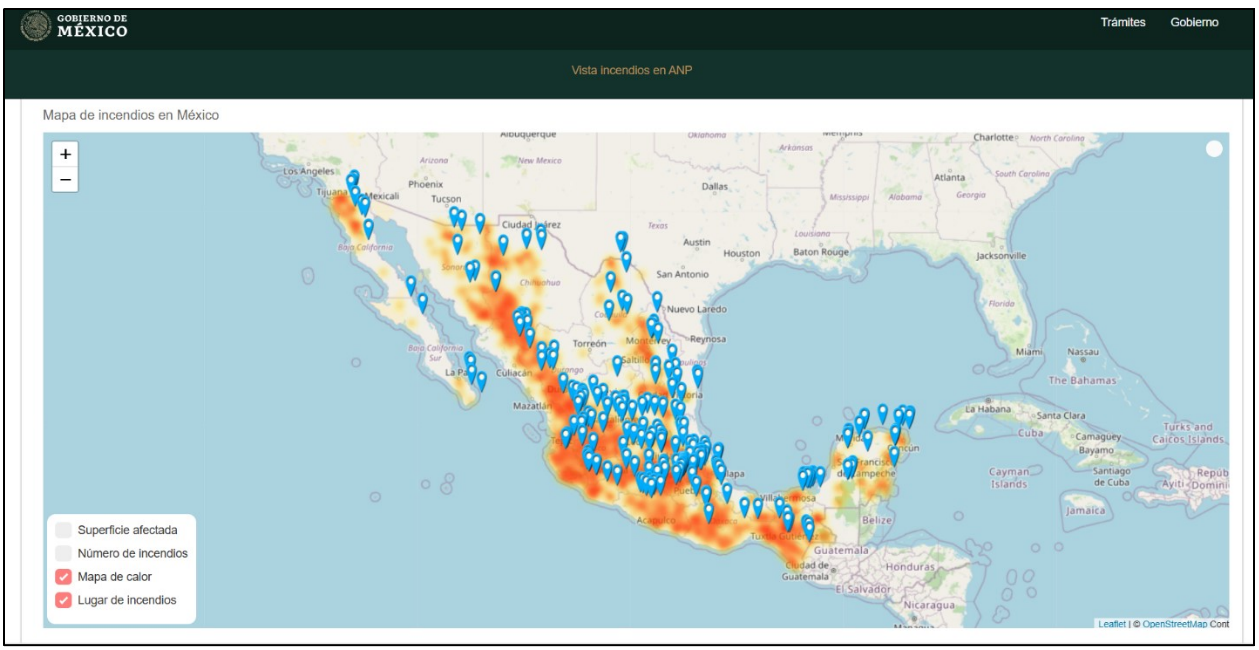


**Figure 5-6: Map of Forest Fires in Mexico in 2023**

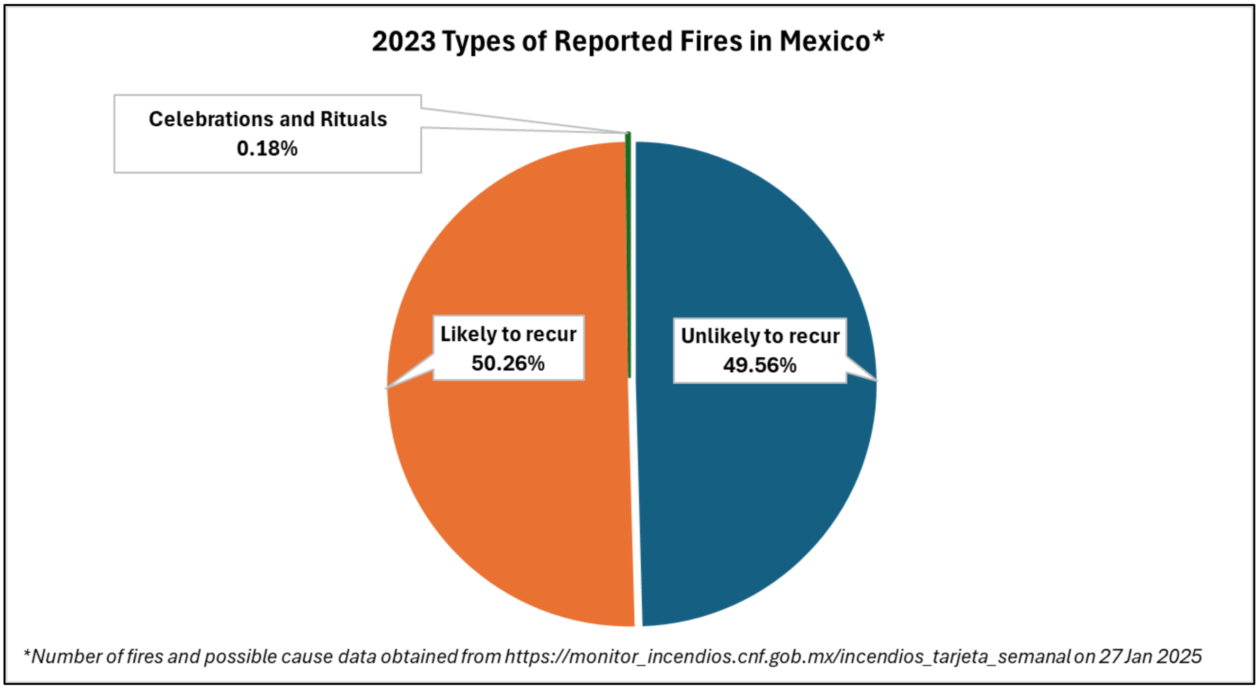


**Figure 5-7: Fires in Mexico in 2023 classified as unlikely or likely to recur based on possible causes**

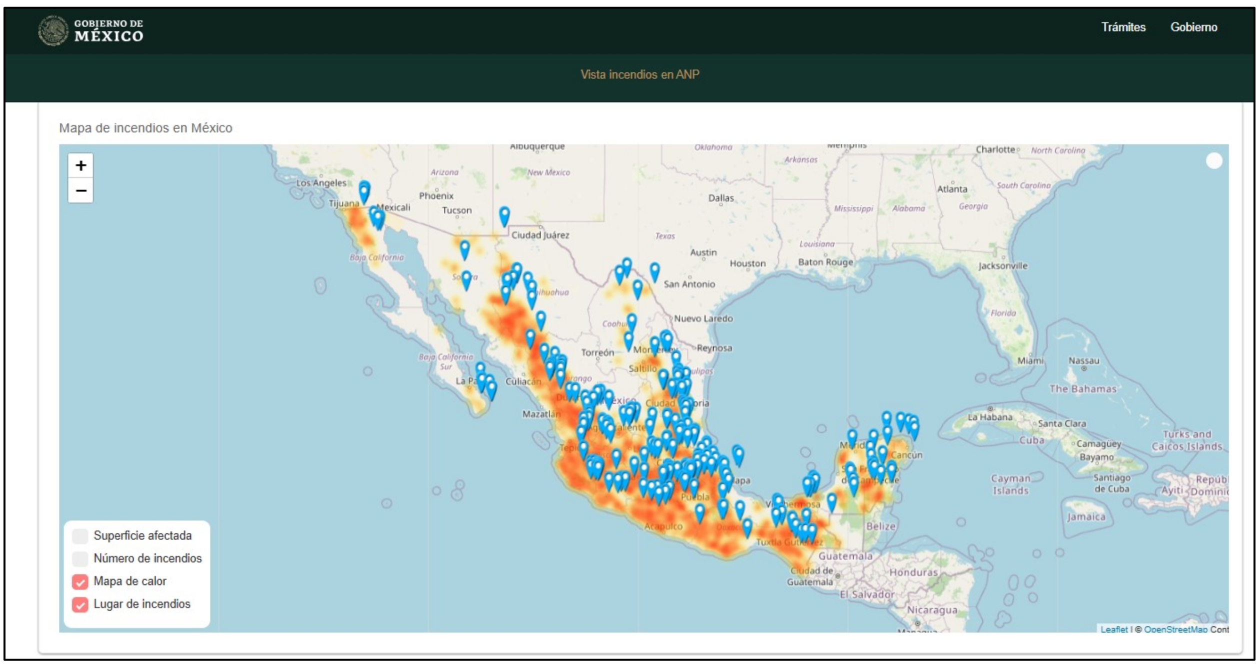


**Figure 5-8: Map of Forest Fires in Mexico in 2024**

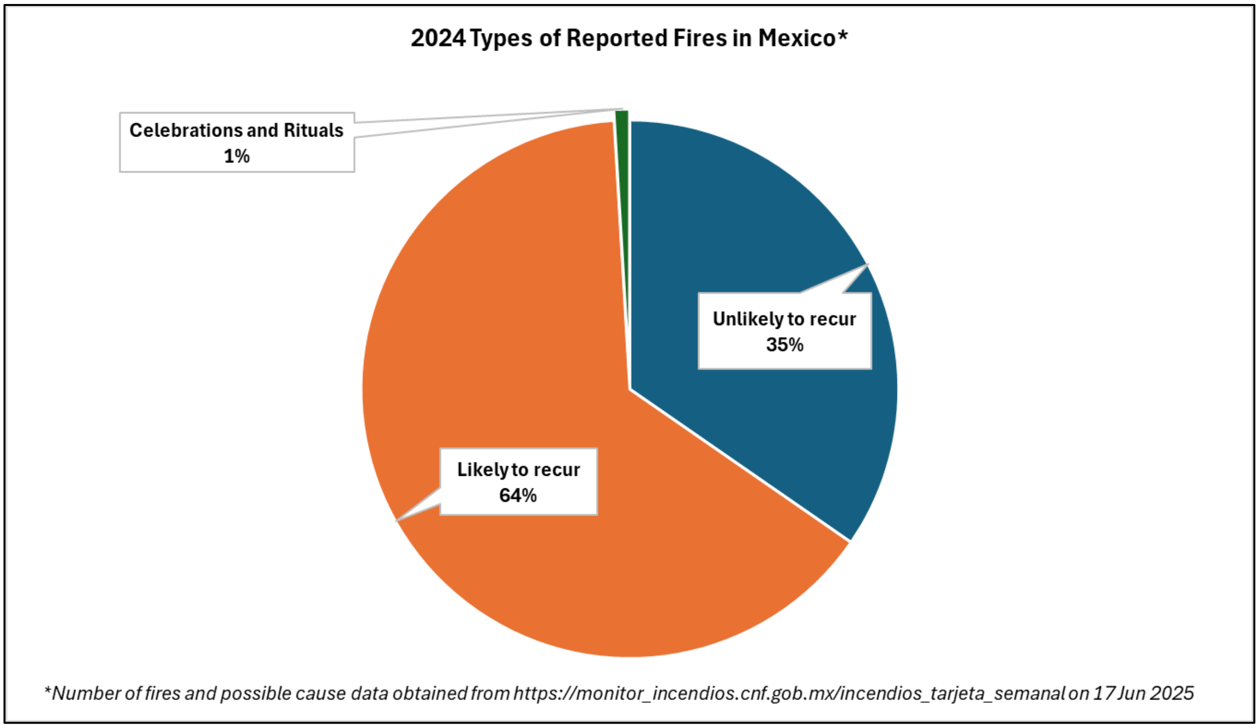


**Figure 5-9: Fires in Mexico in 2024 classified as unlikely or likely to recur based on possible causes**

## SECTION 6: PUBLIC NOTIFICATION AND MITIGATION ACTIONS

### 6.1 OVERVIEW

This section satisfies the requirements in 40 CFR §51.930(a): "A state requesting to exclude air quality data due to exceptional events must take appropriate and reasonable actions to protect public health from exceedances or violations of the NAAQS." These are commonly referred to as mitigation actions.

Each of the specific requirements are addressed individually below.

### 6.2 PROMPT PUBLIC NOTIFICATION

The first mitigation requirement is to "provide for prompt public notification whenever air quality concentrations exceed or are expected to exceed an applicable ambient air quality standard." TCEQ provided (and continues to provide) ozone, fine particulate matter ($PM_{2.5}$), and particulate matter less than or equal to 10 microns in diameter ($PM_{10}$) Air Quality Index (AQI) forecasts for the current day and the next three days for 14 areas in Texas. These forecasts are available to the public on the Today's Texas Air Quality Forecast webpage of the TCEQ website and on EPA's AirNow website.[26, 27]

TCEQ provides near real-time hourly $PM_{2.5}$ measurements from monitors across the state which the public may access on the Latest Hourly $PM_{2.5}$ Levels webpage of the TCEQ website.[28] TCEQ also publishes an AQI Report for many Texas metropolitan areas on the AQI and Data Reports webpage of the TCEQ website, which displays current and historical daily AQI measurements.[29]

Finally, TCEQ publishes daily updates to its air quality forecast to interested parties through e-mail and social media platforms. Any person wishing to receive these updates may register on the Air Quality Forecast and Ozone Action Day Alerts webpage on the TCEQ website.[30] These measures provide daily and near real-time notification to the public, including the media, of current, expected, and changing air quality conditions.

### 6.3 PUBLIC EDUCATION

The second mitigation requirement is to "provide for public education concerning actions that individuals may take to reduce exposures to unhealthy levels of air quality during and following an exceptional event." Through its website, TCEQ provides the public with technical, health, personal activity, planning, and legal information and resources concerning particulate matter (PM) pollution. Besides its website, TCEQ publishes daily updates to its air quality forecast to interested parties through e-mail and social media platforms to provide daily and near real-time notification to the public of current, expected, and changing air quality conditions.

TCEQ maintains a particulate matter webpage, which provides important information regarding the health effects of particulate matter, steps that individuals can take to limit particulate matter emissions, and actions they may wish to take to reduce their exposure to higher levels

[26] http://www.tceq.texas.gov/airquality/monops/forecast_today.html
[27] http://airnow.gov
[28] https://www.tceq.texas.gov/cgi-bin/compliance/monops/select_curlev.pl?user_param=88101
[29] https://www.tceq.texas.gov/airquality/monops/data-reports
[30] http://www.tceq.texas.gov/airquality/monops/ozone_email.html

of particulate matter.[31] The webpage also addresses the latest air quality planning for the particulate matter NAAQS.

TCEQ's main Air webpage provides air quality information on topics such as advisory groups, emissions inventories, air quality modeling and data analysis, scientific field studies, state implementation plan (SIP) revisions, air permits, rules, air monitoring data, and how to file complaints.[32]

TCEQ's website provides a hyperlink to the Texas AirNow website operated by EPA. This website links the public to additional information regarding health effects of PM, strategies for reducing one's exposure to PM, and actions that individuals can take to reduce pollution levels.[33]

The Texas Department of Transportation (TxDOT) sponsors the public education and awareness through the Drive Clean Across Texas campaign.[34] The campaign raises awareness about the impact of vehicle emissions on air quality and motivates drivers to take steps to reduce air pollution.

TCEQ sponsors the Take Care of Texas program, which addresses air quality and provides the public with proactive steps to reduce air pollution particularly on days when air quality forecasts are issued predicting greater potential for high PM concentrations.[35]

## 6.4 IMPLEMENTATION OF MEASURES TO PROTECT PUBLIC HEALTH

The third requirement is to "provide for the implementation of appropriate measures to protect public health from exceedances or violations of ambient air quality standards caused by exceptional events."

Particulate matter regulations are in place in Title 30 Texas Administrative Code Chapter 111 that are applicable to particulate matter control statewide. These regulations are previously described in Section 4: *Not Reasonably Controllable or Preventable*.

## 6.5 MITIGATION PLAN REQUIREMENTS

Section 319(b) of the federal Clean Air Act (FCAA) governs the identification of air quality monitoring data as exceptional events and how that data may be excluded from consideration for air quality regulatory purposes. EPA has adopted rules in 40 Code of Federal Regulation (CFR) §§50.14 and 51.930 to implement FCAA, §319, requiring states to adopt and implement mitigation plans in areas with historically documented or known seasonal events.

For $PM_{2.5}$, TCEQ has developed mitigation plans for exceptional events in Harris County and El Paso County that can be found on the TCEQ website.[36]

[31] https://www.tceq.texas.gov/airquality/sip/criteria-pollutants/sip-pm
[32] http://www.tceq.texas.gov/agency/air_main.html
[33] https://www.airnow.gov
[34] http://www.drivecleanacrosstexas.org
[35] http://takecareoftexas.org/air-quality
[36] https://www.tceq.texas.gov/downloads/air-quality/modeling/exceptional/texas-ee-mitigation-plan-final.pdf

# SECTION 7: PUBLIC COMMENT PERIOD

## 7.1 OVERVIEW

This section satisfies the Exceptional Events Rule Requirement at 40 CFR §50.14(c)(3)(iv)(A), (B), (C): "document that the air agency followed the public comment process and that the comment period was open for a minimum of 30 days, which could be concurrent with the beginning of EPA's initial review period of the associated demonstration provided the air agency can meet all requirements in this paragraph; submit the public comments received along with its demonstration to the Administrator; and address in the submission to the Administrator those comments disputing or contradicting factual evidence provided in the demonstration."

## 7.2 PUBLIC COMMENT PROCESS

The public comment period for this demonstration is from August 5, 2025, through September 5, 2025. During this comment period, the demonstration is available on TCEQ's website at https://www.tceq.texas.gov/airquality/monops/pm_flags.html. Written comments will be accepted via mail or e-mail. TCEQ will include all comments received or postmarked by 5:00 p.m. CDT on September 5, 2025, with the final demonstration submitted to EPA. TCEQ will also address those comments disputing or contradicting factual evidence provided in the final demonstration.

## SECTION 8: CONCLUSION

This exceptional events demonstration shows that the Karnack, Austin Webberville, Austin North Hills, and National Seashore monitors were impacted by smoke and dust from prescribed fire, fires in Mexico, fireworks, and African dust. These exceptional events caused the elevated $PM_{2.5}$ concentrations on the dates listed in Table 1-1, as explained in Section 3: *Clear Causal Relationship*.

This demonstration shows that the exceptional events that influenced $PM_{2.5}$ concentrations are consistent with EPA's definition of an exceptional event under the 2016 Exceptional Events Rule. TCEQ requests that EPA concur with the exclusion from regulatory decisions the $PM_{2.5}$ concentration(s) in Table 1-1. The days and sites for which TCEQ is requesting concurrence were impacted by events consistent with EPA's definition of "unusual or naturally occurring events" that can affect air quality but are not reasonably controllable using techniques that tribal, state, or local air agencies may implement in order to attain and maintain the 2024 primary annual $PM_{2.5}$ NAAQS.