EXCEPTIONAL EVENTS DEMONSTRATION FOR 2023 $PM_{2.5}$ EXCEEDANCES AT ATASCOSA, HIDALGO, TARRANT, AND WEBB COUNTIES

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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 2023, in Atascosa County (Von Ormy Highway 16 monitor), Hidalgo County (Edinburg East Freddy Gonzalez Drive monitor), Tarrant County (Fort Worth Northwest and Haws Athletic Center monitors), and Webb County (World Trade Bridge monitor). This demonstration shows that concentrations of $PM_{2.5}$ at these air monitoring sites were impacted by exceptional events on 27 days in 2023.

The particulate matter measurements on the proposed exceptional event days are listed below in Table 1-1: *Proposed Exceptional Events in 2023*. 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 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 2023

EE Group	Date	Site Name	Exceedance Concentration (µg/m³)	Type of Event	Tier
1	1/2/23	Edinburg East Freddy Gonzalez Drive	30.0	Fire - Mexico/Central America	1
1	1/3/23	Edinburg East Freddy Gonzalez Drive	24.9	Fire - Mexico/Central America	2
2	2/26/23	Haws Athletic Center	26.2	High Winds	1
2	2/27/23	Fort Worth Northwest	32.9	Fire - Mexico/Central America	1
2	2/27/23	Haws Athletic Center	39.8	Fire - Mexico/Central America	1
3	3/1/23	Edinburg East Freddy Gonzalez Drive	24.0	Fire - Mexico/Central America	2
3	3/2/23	Edinburg East Freddy Gonzalez Drive	23.2	Fire - Mexico/Central America	2
4	3/27/23	Edinburg East Freddy Gonzalez Drive	23.7	Fire - Mexico/Central America	2

EE Group	Date	Site Name	Exceedance Concentration (µg/m³)	Type of Event	Tier
5	4/4/23	Edinburg East Freddy Gonzalez Drive	23.7	Fire - Mexico/Central America	2
6	4/15/23	Edinburg East Freddy Gonzalez Drive	23.1	Fire - Mexico/Central America	2
7	5/5/23	World Trade Bridge	31.4	Fire - Mexico/Central America	1
7	5/5/23	Edinburg East Freddy Gonzalez Drive	28.2	Fire - Mexico/Central America	2
7	5/6/23	Von Ormy Highway 16	28.1	Fire - Mexico/Central America	2
7	5/6/23	Edinburg East Freddy Gonzalez Drive	30.5	Fire - Mexico/Central America	1
7	5/6/23	World Trade Bridge	39.8	Fire - Mexico/Central America	1
8	5/11/23	Edinburg East Freddy Gonzalez Drive	30.3	Fire - Mexico/Central America	1
8	5/12/23	Edinburg East Freddy Gonzalez Drive	32.9	Fire - Mexico/Central America	1
8	5/12/23	World Trade Bridge	38.7	Fire - Mexico/Central America	1
8	5/12/23	Haws Athletic Center	24.6	Fire - Mexico/Central America	2
9	6/14/23	Haws Athletic Center	25.0	Fire - Mexico/Central America	1
9	6/15/23	Haws Athletic Center	27.8	Fire - Mexico/Central America	1
9	6/15/23	World Trade Bridge	33.1	Fire - Mexico/Central America	1
9	6/16/23	World Trade Bridge	28.8	Fire - Mexico/Central America	2
10	7/15/23	Edinburg East Freddy Gonzalez Drive	23.4	African Dust	2
10	7/16/23	Edinburg East Freddy Gonzalez Drive	23.0	African Dust	2
11	7/26/23	Edinburg East Freddy Gonzalez Drive	26.1	African Dust	2
11	7/27/23	Edinburg East Freddy Gonzalez Drive	27.1	African Dust	2

(µg/m³) = micrograms per cubic meter

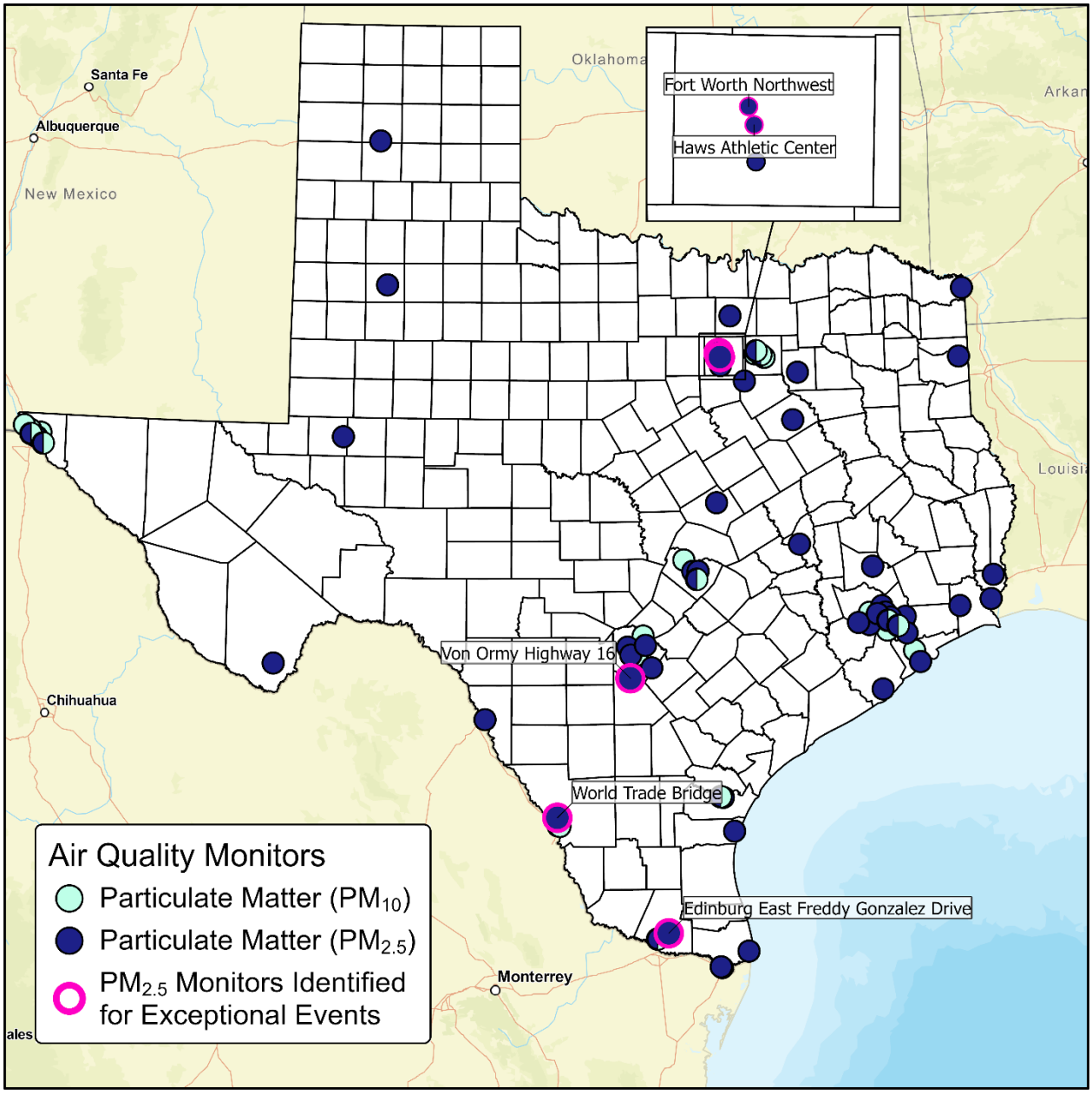

Figure 1-1: Map of Texas with Monitors Identified for Exceptional Events

Table 1-2: Monitor Details

Site Name	Von Ormy Highway 16	Edinburg East Freddy Gonzalez Drive	Haws Athletic Center	Fort Worth Northwest	World Trade Bridge
Air Quality System (AQS) Number	480131090	482151046	484391006	484391002	484790313
Activation Date	5/29/2020	7/8/2015	4/1/2001	1/1/1975	8/13/2002
Address	17534 North State Highway 16	1491 East Freddy Gonzalez Drive	600 1/2 Congress St	3317 Ross Ave	Mines Road 11601 FM 1472
County	Atascosa	Hidalgo	Tarrant	Tarrant	Webb
Latitude/ Longitude	29.1628698, -98.5891166	26.2884857, -98.1520588	32.7591555, -97.3422980	32.8058061, -97.3565215	27.5996022, -99.5334135
Pollutant Instrumentation	$PM_{2.5}$	$PM_{2.5}$	$PM_{2.5}$	VOC, Carbonyl, NO_X, O2, $PM_{2.5}$	$PM_{2.5}$
Meteorological Instrumentation	Temperature, Wind	Temperature, Wind	--	Dew Point, Relative Humidity, Solar Radiation, Temperature, Wind	--

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 µg/m³ (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 July 8, 2025, TCEQ submitted an initial notification to EPA Region 6. An addendum was sent to EPA Region 6 revising event types for certain dates on July 15, 2025. 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 because 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. The 2022 and 2024 days impacted by exceptional events at these monitors and the details of the events are available in TCEQ's *Exceptional Event Demonstration for 2022 $PM_{2.5}$ Exceedances at Atascosa, Hidalgo, Nueces, Tarrant and Webb Counties* and *Exceptional Event Demonstration for 2024 $PM_{2.5}$ Exceedances at Atascosa, Hidalgo, Nueces, Tarrant and Webb Counties*, respectively.

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

Monitoring Site	2024 DV without EPA Concurrence (µg/m³)	2024 DV with EPA Concurrence (µg/m³)
Von Ormy Highway 16 (480131090)	9.5	9.0
Edinburg East Freddy Gonzalez Drive (482151046)	10.3	9.0
Haws Athletic Center (484391006)	9.4	9.0
Fort Worth Northwest (484391002)	9.1	9.0
World Trade Bridge (484790313)	9.7	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 $PM_{2.5}$

[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

exceptional events for the days included in the initial notification letter (Appendix D), which shows “r” flag applied for all types.

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 2023 events and the general meteorological conditions that caused smoke and dust to travel to the five monitoring sites. As identified in Table 1-1, events were categorized into 11 distinct groups based on single day events or episodes with types of events (African Dust, Fires-Mexico/Central America, 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 ATASCOSA COUNTY BACKGROUND

The Atascosa County area is located in the Rio Grande Plain region of South Texas. The county is part of the San Antonio-New Braunfels metropolitan statistical area (MSA) and has a population of approximately 48,981 people.[7] The area covers 1,221 square miles and is geographically characterized by plains and rolling hills, with the Atascosa River running through its entirety. Atascosa County experiences a subtropical climate, characterized by hot, humid summers and mild winters. Rainfall is fairly distributed throughout the year, with a peak storm season from March to May.

2.3 HIDALGO COUNTY BACKGROUND

The Hidalgo County area is located in the Rio Grande Valley region of South Texas. The county is part of both a Metropolitan Statistical Area (MSA) as well as a Combined Statistical Area (CSA) with a population of approximately 870,781 people.[7] The area covers 1,583 square miles and is geographically characterized by predominantly flat terrain with the Rio Grande River forming a natural border. Hidalgo 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 March to May.

2.4 TARRANT COUNTY BACKGROUND

The Tarrant County area is located in the North Texas Region. The county is part of the Dallas-Fort Worth-Arlington Metropolitan Statistical Area (MSA) and has a population of approximately 2,110,640 people.[7] The area covers 902 square miles and is geographically characterized by several lakes, as well as the Trinity River that flows through the county. Tarrant County experiences a subtropical climate with hot, humid summers and mild winters, with two distinct rainy seasons in spring and fall.

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[7] https://www.census.gov/library/stories/state-by-state/texas.html

2.5 WEBB COUNTY BACKGROUND

The Webb County area is located in the South Texas Plains of the South Texas Region. The county is part of the Laredo Metropolitan Area, a Core Based Statistical Area (CBSA) and has a population of approximately 267,114 people.[7] The area covers 3,376 square miles and is geographically characterized by its flat terrain and the Rio Grande River that acts as a natural border to Mexico. Webb County experiences a semi-arid climate with hot, dry summers and mild winters. Rainfall is low, with a short but intense peak storm season in spring.

2.6 NARRATIVE FOR EACH GROUP OF EVENT DAYS

All weather maps, graphs, and smoke layer maps are included in Appendix A. The National Oceanic and Atmospheric Administration's (NOAA) National Weather Service (NWS) forecasts and discussions are included in Appendix 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:
  - Corpus Christi office: World Trade Bridge monitor
  - Brownsville office: Edinburg East Freddy Gonzalez Drive monitor
  - Dallas/Fort Worth office: Fort Worth Northwest and Haws Athletic Center monitors
- 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.

2.6.1 Group 1 – Summary of January 2 and January 3, 2023, Fire (Mexico/Central America) $PM_{2.5}$ Event for the Edinburg East Freddy Gonzalez Drive Monitor

$PM_{2.5}$ concentrations were elevated on January 2 and 3, 2023, at the Edinburg East Freddy Gonzalez Drive monitor due to smoke from fires in Mexico, as shown in Figure 2-1*: Hourly $PM_{2.5}$ Concentrations on Days around Event (January 2-3, 2023) for the Edinburg East Freddy Gonzalez Drive Monitor.*

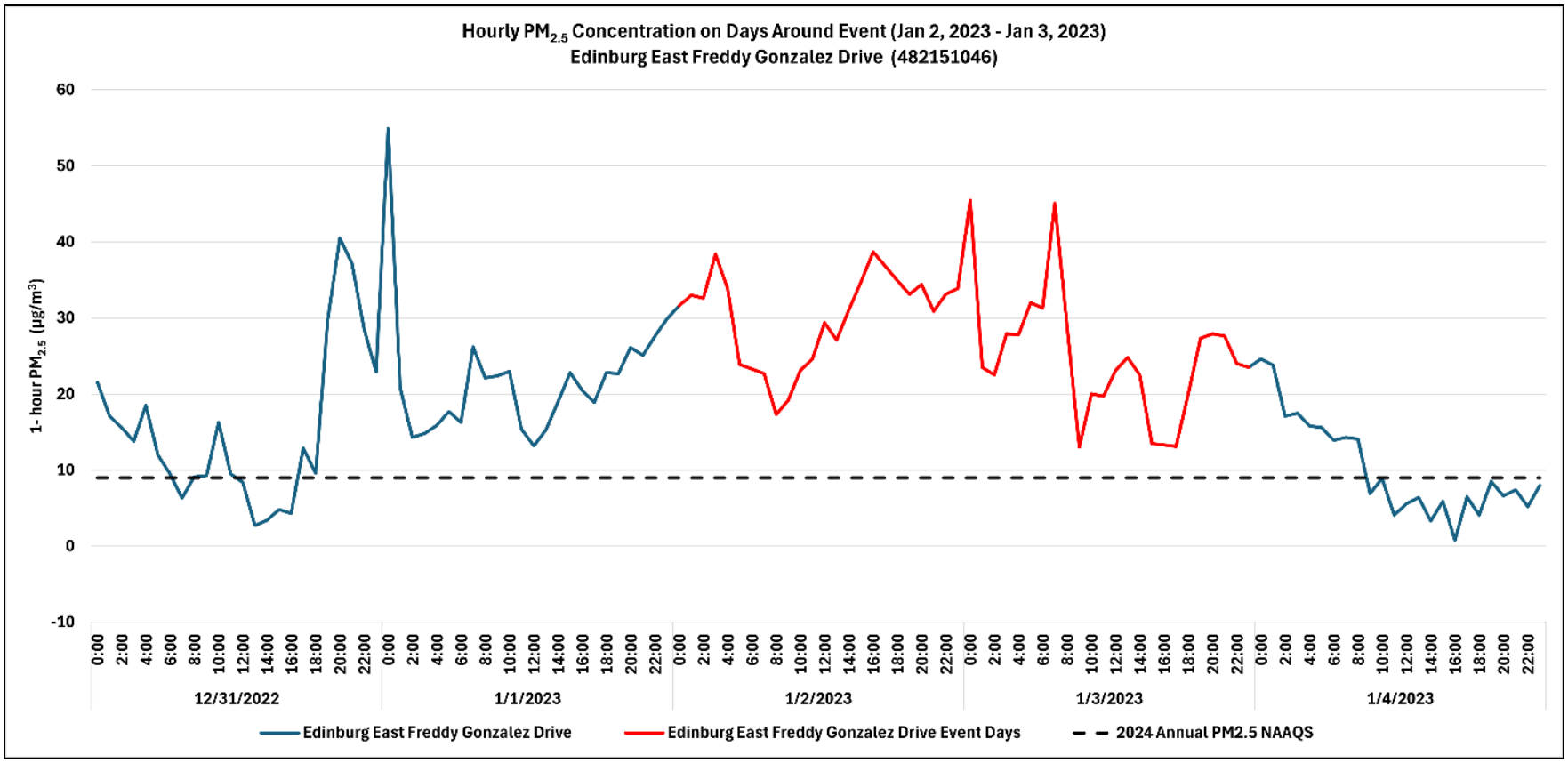

Figure 2-1: Hourly $PM_{2.5}$ Concentrations on Days around Event (January 2-3, 2023) for the Edinburg East Freddy Gonzalez Drive Monitor

On January 2, 2023, there was a stationary front that extended from the north Texas panhandle to the Virginias. A cold front was moving across New Mexico, from a low-pressure system situated over the western U.S. (Figure A-1). Winds at the surface near the monitor were out of the southeast around 10-15 knots. The 500 mb heights chart shows a mid-level trough over the southwestern U.S., with the mid-level low pressure system situated over Arizona and Utah (Figure A-2). The sounding from Brownsville, Texas shows southeasterly and southerly winds in the lower levels of the atmosphere associated with flow onto land from the Gulf (Figure A-3). Light levels of smoke can be seen drifting into South Texas from Mexico on the NOAA HMS map on this day (Figure A-4).

On January 3, 2023, the cold front moved into Texas and extended from northern Missouri south through the Corpus Christi and Brownsville areas of Texas, as seen on the surface weather chart (Figure A-5). Winds ahead of the cold front in South Texas were coming out of the south around 15 knots, while winds behind the front were northwesterly. The 500 mb heights chart (Figure A-6) shows a mid-level trough over the central U.S. with a mid-level low pressure system centered over Kansas and Nebraska. Mid-level winds over South Texas were out of the southwest around 50 knots, indicating a jet stream enhancing transport aloft from the west and south. The sounding from Brownsville, Texas (Figure A-7) shows southerly and southwesterly winds in the lowest level of the atmosphere along with abundant moisture, which is associated with the flow onto land from the Gulf ahead of the cold front. These winds at the surface and mid-level transported smoke from fires in Mexico. Light smoke along the South Texas coastline is indicated on the NOAA HMS map, having been ushered out into the Gulf ahead of the advancing cold front (Figure A-8).

Figure 2-2: *Percentage of Fire Instances Reported by the Mexican Government, on and around January 2-3, 2023,* shows the reported fires and causes in Mexico, with about 33% not likely to recur (caused by smokers).

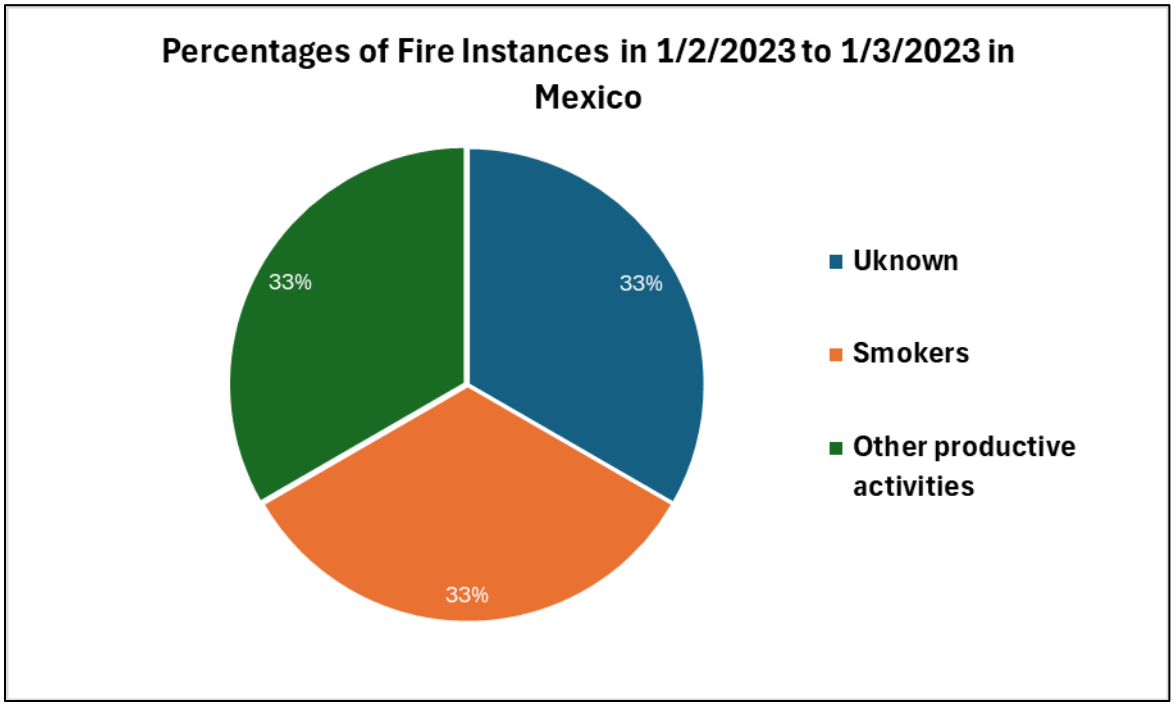

Figure 2-2: Percentage of Fire Instances Reported by the Mexican Government, on and around January 2-3, 2023

2.6.2 Group 2 – Summary of February 26 and February 27, 2023, Fire (Mexico/Central America) and High Wind $PM_{2.5}$ Event for the Haws Athletic Center and Fort Worth Northwest Monitors

The Haws Athletic Center was impacted by blowing dust from high winds on February 26, 2023. On February 27, 2023, the Haws Athletic Center and Fort Worth Northwest monitors were both impacted by smoke from fires in Mexico, as well as residual dust from the previous high wind day. Elevated $PM_{2.5}$ concentrations on these two days are shown in Figure 2-3: *Hourly $PM_{2.5}$ Concentrations on Days Around Event (February 26-27, 2023) for the Haws Athletic Center and Fort Worth Northwest Monitors.*

On February 26, 2023, a stationary front was located over Central Texas, with variable surface winds (Figure A-9). In the 500 mb map, a zonal pattern was present across Texas, with an upper-level low in the western U.S. (Figure A-10). This low-pressure system was associated with a cold front that was present over Arizona in the morning, moving east. The cold front reached the Fort Worth area in the early hours of February 27, 2023. On February 27, the 500 mb chart (Figure A-11) shows a zonal pattern over the U.S. with a low height center over Missouri. This low stacks down to the surface as a low-pressure center is seen on the surface chart over the central U.S. (Figure A-12). The cold front associated with this low-pressure center had just passed over the monitors the night before, likely bringing higher sustained surface winds to the area. The rawinsonde sounding at Fort Worth (Figure A-13) shows winds that are in-phase throughout the vertical column. This indicates that energy from upper atmospheric winds can be more easily transferred downward through the mid and lower atmosphere. There was a low-level jet stream present at 850 mb with 60 knot wind speeds. The high winds due to the low-level jet stream were able to mix down in the atmosphere, bringing high winds to the surface aided by the cold front. These meteorological conditions created one of the strongest dust storms in West Texas over the last two decades.[8]

These high surface winds created blowing dust that contributed to the higher concentration of $PM_{2.5}$ at the monitors. Intense winds and blowing dust associated with this weather system were also documented in NWS forecasts for both days (Figure B-1, B-2, B-3, and B-4) and in NWS discussions on February 26, 2023, for West Texas (Figures B-5 and B-6). Additionally, light to medium levels of smoke from fires in Mexico can be seen in Central/South Texas on the NOAA HMS fire and smoke map on February 27, 2023 (Figure A-14).

[8] https://acp.copernicus.org/articles/24/13733/2024/

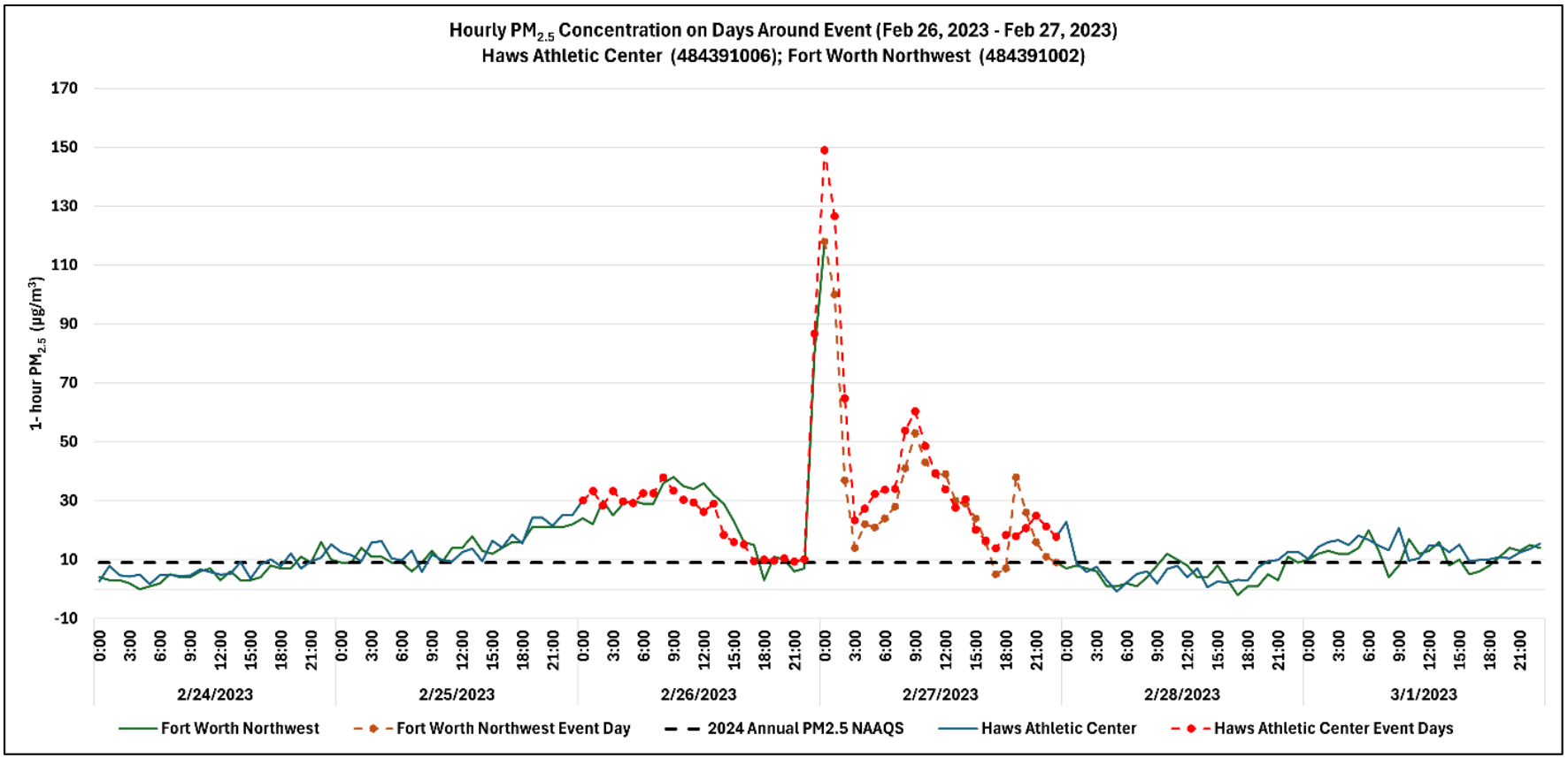

Figure 2-3: Hourly $PM_{2.5}$ Concentrations on Days Around Event (February 26-27, 2023) for the Haws Athletic Center and Fort Worth Northwest Monitors

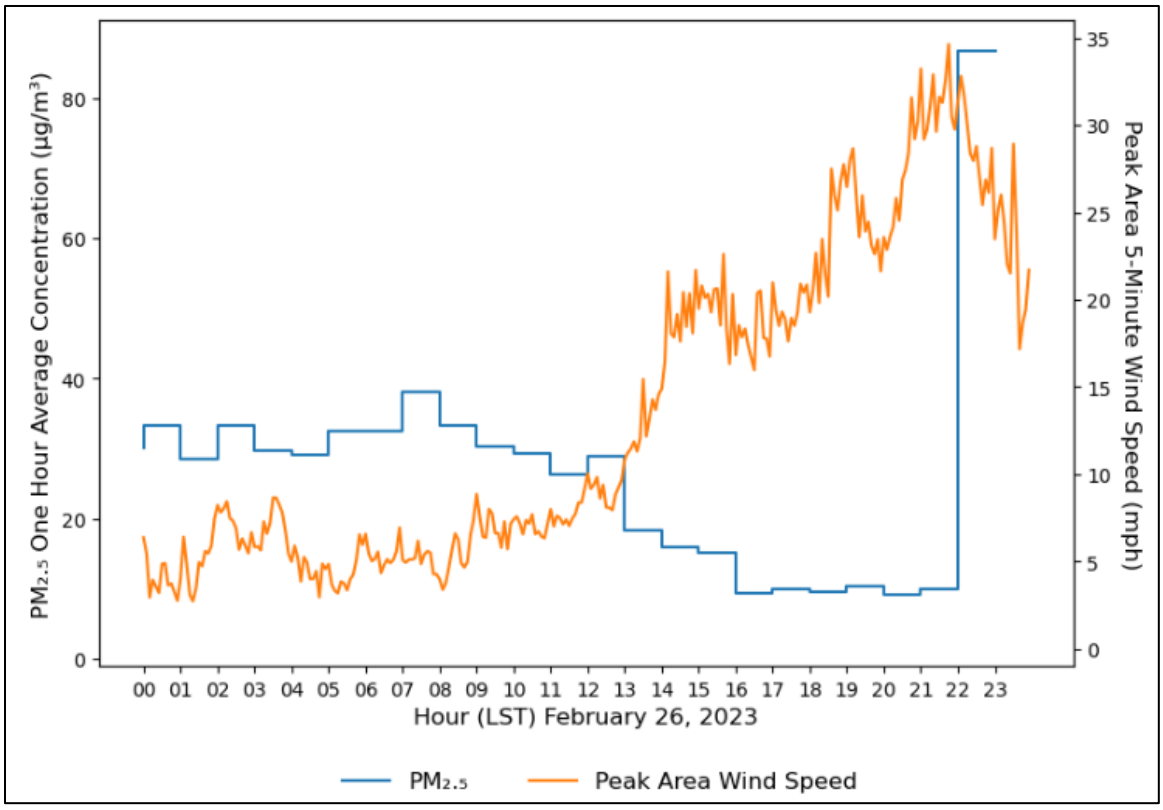

Figure 2-4: Hourly $PM_{2.5}$ concentrations at the Haws Athletic Center Monitor Compared to Peak Area 5-minute Wind Speeds in Tarrant County on February 26, 2023

Because the highest $PM_{2.5}$ concentrations on February 26, 2023, were in the last few hours of the day, it was helpful to review the wind data on this day. The plot in Figure 2-4: *Hourly $PM_{2.5}$ concentrations at the Haws Athletic Center Monitor Compared to Peak Area 5-minute Wind Speeds in Tarrant County on February 26, 2023,* shows the increasing wind speeds, up to almost 35 mph around 9 p.m. local time, and this corresponded to the cold front moving through the area of the monitor. $PM_{2.5}$ concentrations spike shortly after the max wind speed, indicating blowing dust from the high winds.

Figure 2-5: *Percentage of Fire Instances Reported by the Mexican Government, on and around February 27, 2023*, shows the reported fire instances in Mexico, with around half considered to be unlikely to recur.

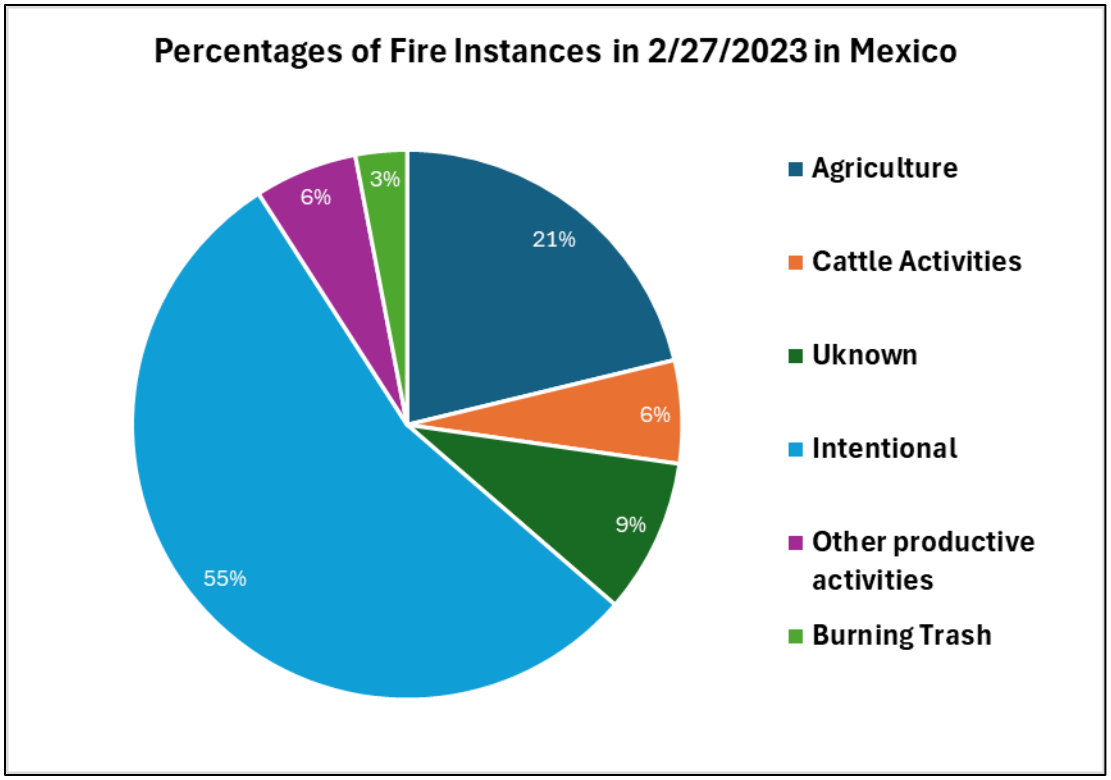

Figure 2-5: Percentage of Fire Instances Reported by the Mexican Government, on and around February 27, 2023

2.6.3 Group 3 – Summary of March 1 and March 2, 2023, Fire (Mexico/Central America) $PM_{2.5}$ Event for the Edinburg East Freddy Gonzalez Drive Monitor

Smoke from fires in Mexico impacted $PM_{2.5}$ concentrations at the Edinburg East Freddy Gonzalez Drive monitor on March 1 and March 2, 2023. Elevated hourly $PM_{2.5}$ concentrations can be seen on these days in Figure 2-6: *Hourly $PM_{2.5}$ Concentrations on Days around Event (March 1-2, 2023) for the Edinburg East Freddy Gonzalez Drive Monitor*.

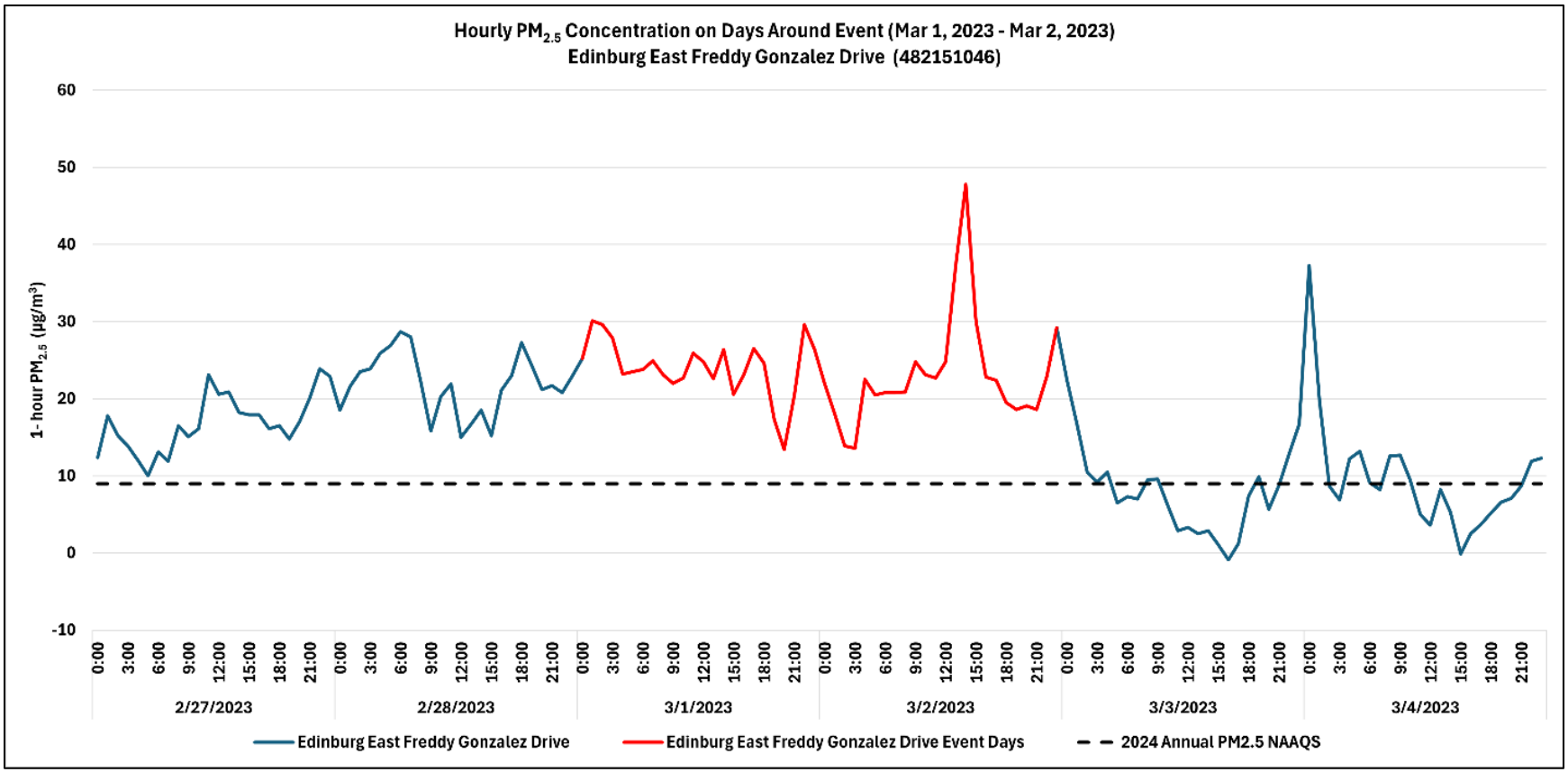

Figure 2-6: Hourly $PM_{2.5}$ Concentrations on Days around Event (March 1-2, 2023) for the Edinburg East Freddy Gonzalez Drive Monitor

On March 1, 2023, a zonal pattern is present over most of the U.S. at the 500 mb level, including Texas (Figure A-15). On the surface level, a cold front moved into North Texas from the north, while southerly winds flowed onto the Texas coast from the Gulf (Figures A-16 and A-17). Light to medium levels of smoke from fires in Mexico can be seen along the Texas coastline in Figure A-18.

On March 2, 2023, the 500 mb chart (Figure A-20) shows 60 knot winds over Texas, with a low digging into the Southwestern U.S. This upper-level low pressure system stacked down to a low-pressure center on the surface over New Mexico, while a stationary front sat over North Texas (A-19). Surface and low-level winds were out of the south/southeast (Figure A-21). Light to medium levels of smoke continue to drift into South Texas as seen in Figure A-22.

Figure 2-7: Percentage of Fire Instances Reported by the Mexican Government, on and around March 1-2, 2023, shows the reported fires in Mexico, with about 70% not likely to recur (intentional, hunting, campfires, and smokers).

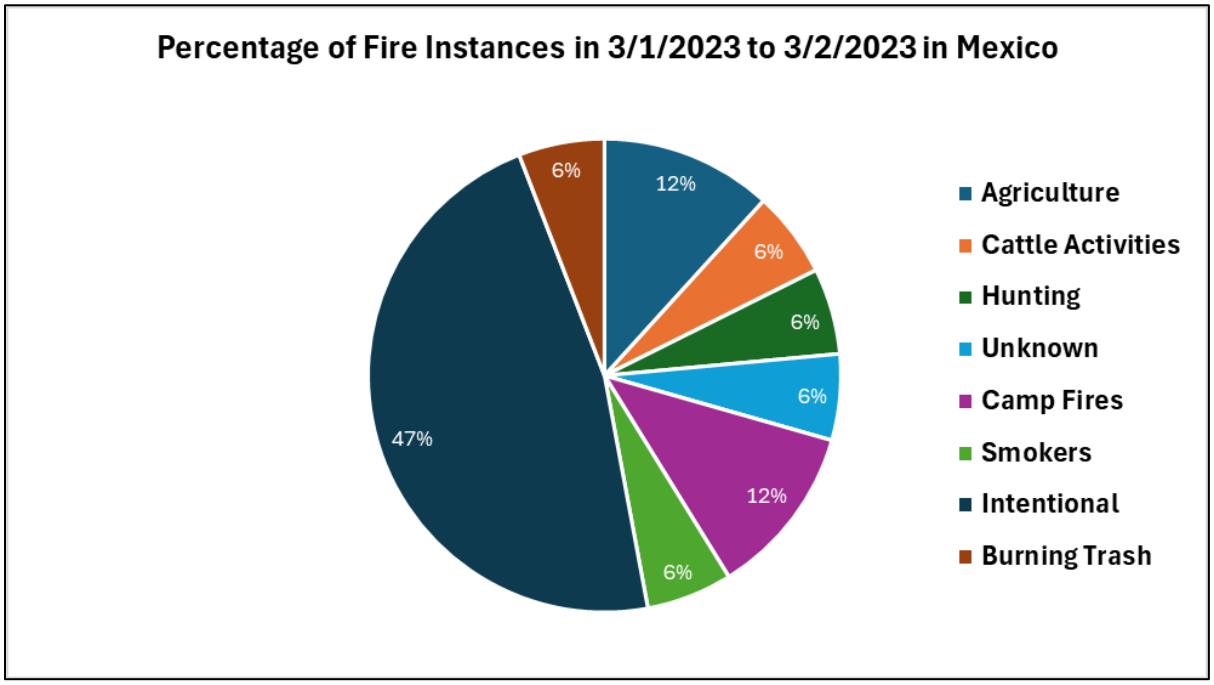

Figure 2-7: Percentage of Fire Instances Reported by the Mexican Government, on and around March 1-2, 2023

2.6.4 Group 4 – Summary of March 27, 2023, Fire (Mexico/Central America) $PM_{2.5}$ Event for the Edinburg East Freddy Gonzalez Drive Monitor

There were elevated concentrations of $PM_{2.5}$ at the Edinburg East Freddy Gonzalez Drive monitor on March 27, 2023, due to fires in Mexico. The hourly $PM_{2.5}$ concentrations on this day can be seen in Figure 2-8: *Hourly $PM_{2.5}$ Concentrations on Days around Event (March 27, 2023) for the Edinburg East Freddy Gonzalez Drive Monitor.*

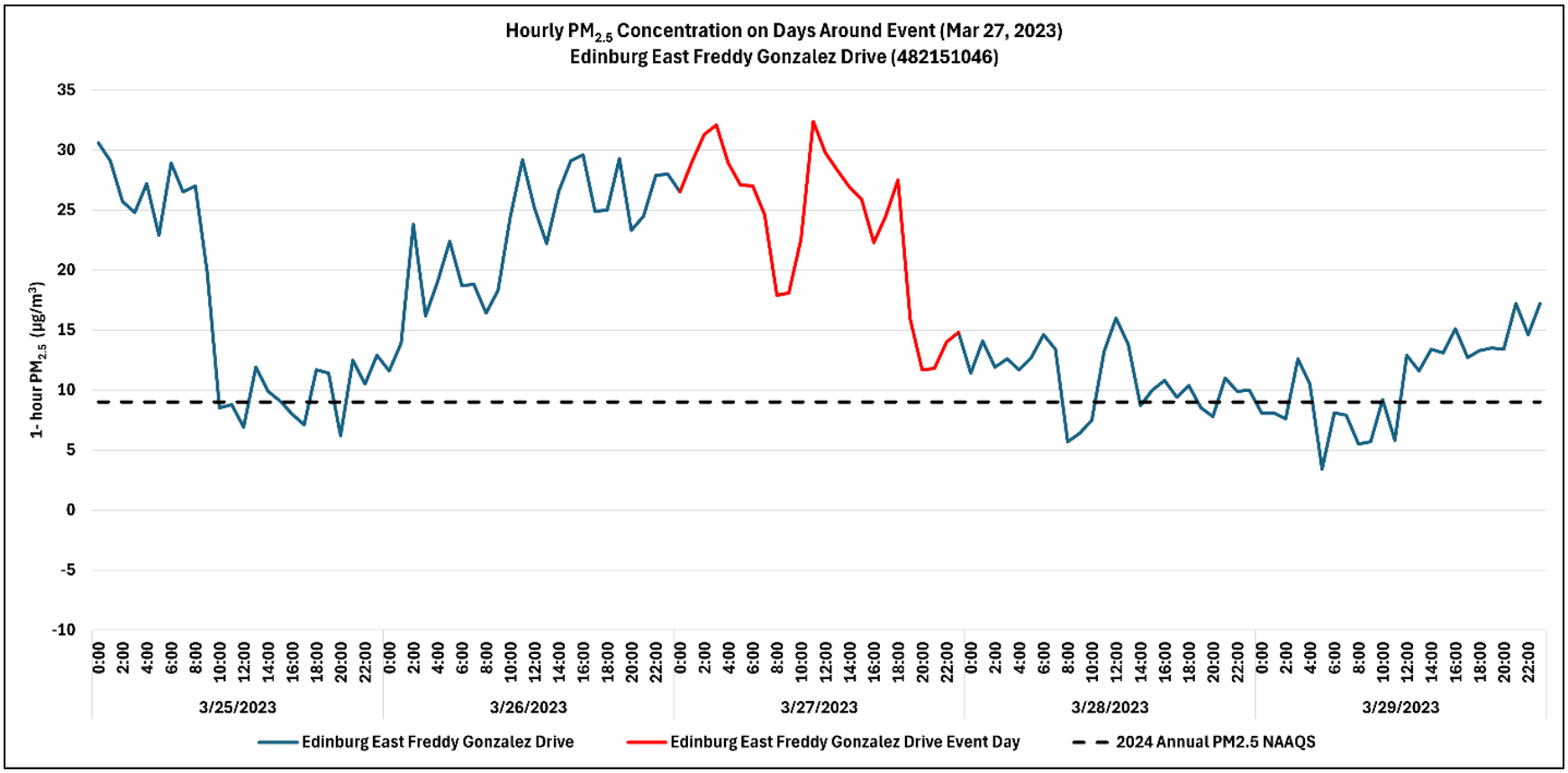

Figure 2-1: Hourly $PM_{2.5}$ Concentrations on Days around Event (March 27, 2023) for the Edinburg East Freddy Gonzalez Drive Monitor

On March 27, 2023, there is broad troughing at 500 mb over the entire U.S. with a southwesterly flow over Texas (Figure A-24). On the surface level, a cold front was pushing through Texas, with winds out of the southeast ahead of the cold front (Figure A-23), and southeasterly winds were also discussed in the NWS area forecast (Figure B-7). This flow provided transport of particulate matter from the fires in Mexico to the monitor in South Texas. The observed sounding in Brownsville shows saturation at the surface with a possible low cloud or fog event that day (Figure A-25). Two subsidence inversions are seen at 900 mb and 800 mb, respectively. Those subsidence inversions indicate downward movement of air, which is conducive for trapping any particulate matter that was transported from Mexican and Central American fires. Light to medium levels of smoke can be seen over the Texas coastline in Figure A-26.

Figure 2-9: *Percentage of Fire Instances by the Mexican Government, on and around March 27, 2023*, shows the reported fires in Mexico, with approximately 70% not likely to recur (intentional, hunting, campfires, and burning trash).

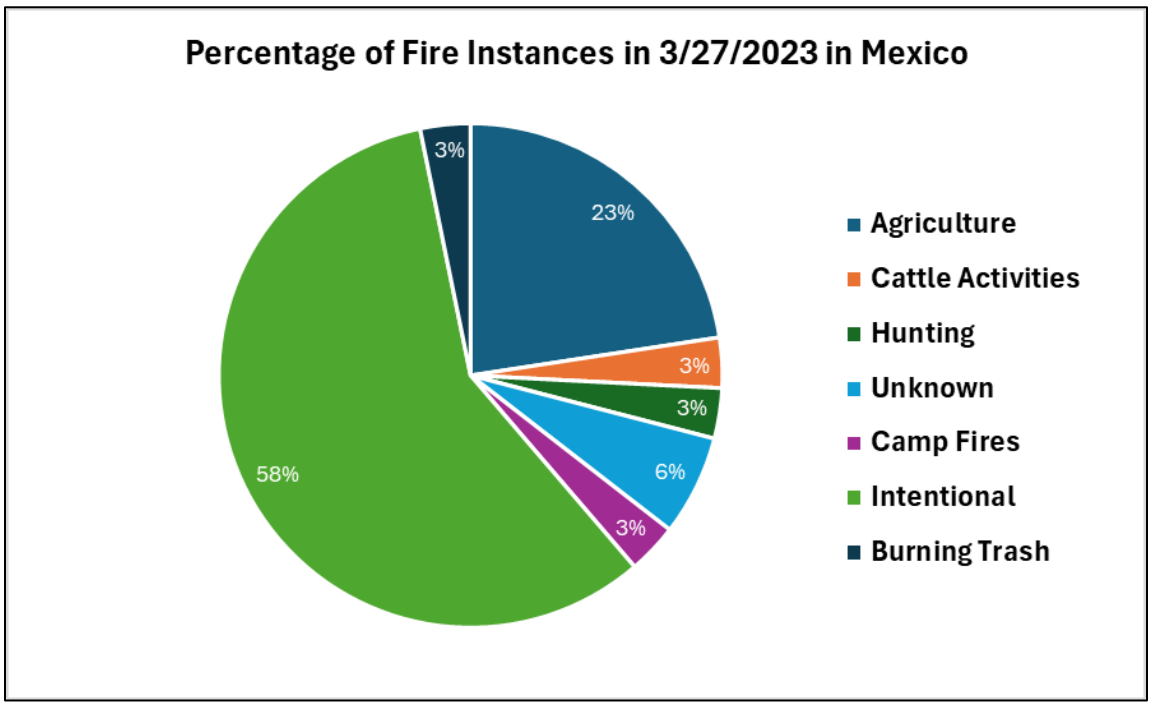

Figure 2-9: Percentage of Fire Instances by the Mexican Government, on and around March 27, 2023

2.6.5 Group 5 – Summary of April 4, 2023, Fire (Mexico/Central America) $PM_{2.5}$ Event for the Edinburg East Freddy Gonzalez Drive Monitor

High $PM_{2.5}$ concentrations at the Edinburg East Freddy Gonzalez Drive monitor were due to fires in Mexico on April 4, 2023. The hourly $PM_{2.5}$ concentrations on this day can be seen in Figure 2-10: *Hourly $PM_{2.5}$ Concentrations on Days around Event (April 4, 2023) for the Edinburg East Freddy Gonzalez Drive Monitor.*

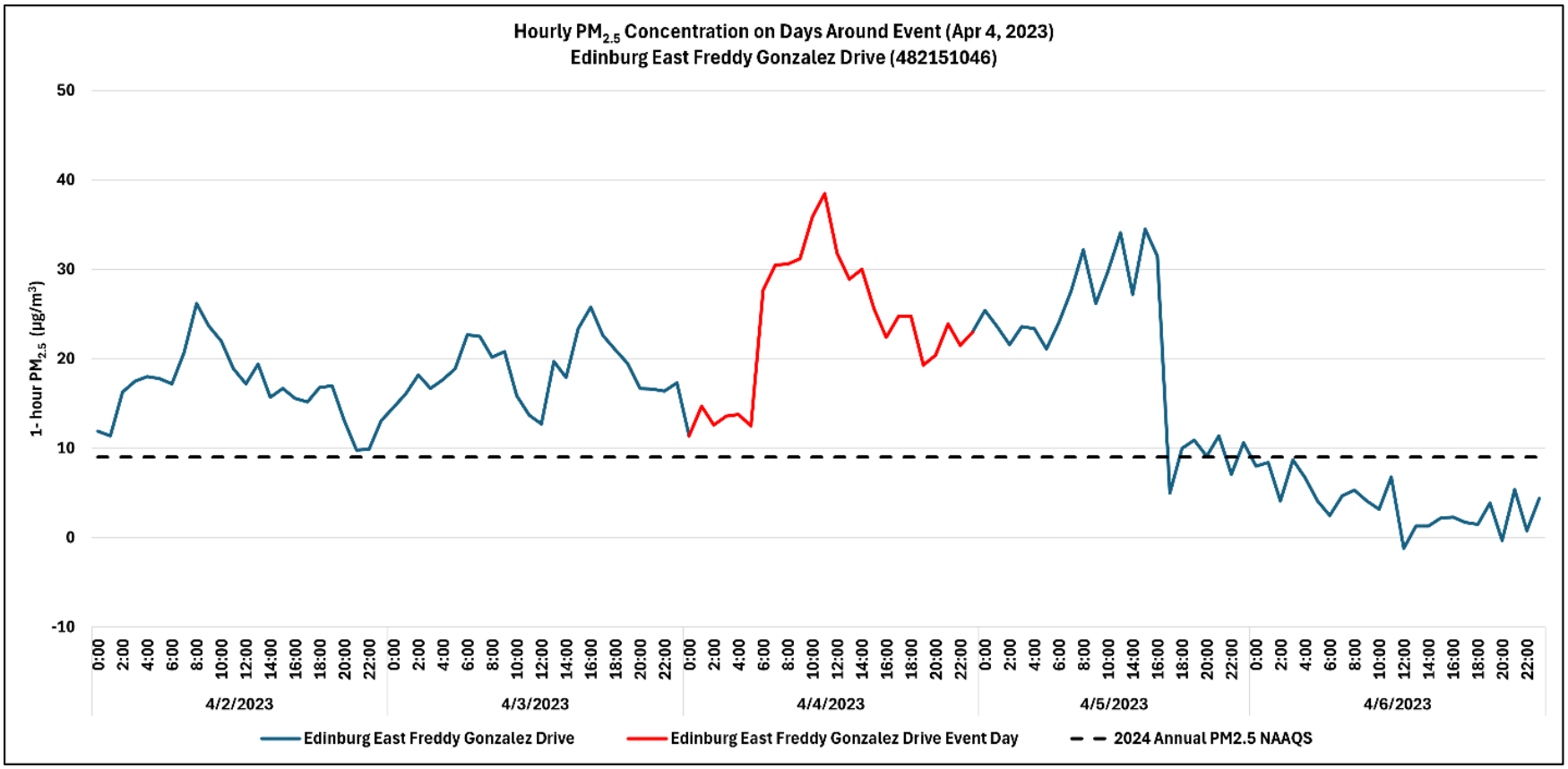

Figure 2-10: Hourly $PM_{2.5}$ Concentrations on Days around Event (April 4, 2023) for the Edinburg East Freddy Gonzalez Drive Monitor

On April 4, 2023, there is a longwave trough over the Rocky Mountains with a low height center over the Four Corners area (southwestern corner of Colorado, southeastern corner of Utah, northeastern corner of Arizona, and northwestern corner of New Mexico), as seen on the 500 mb map (Figure A-28). In the surface analysis map, wind flows from the southwest over Texas with a high height center over the Gulf (Figure A-27), and southerly wind flow was documented in the NWS forecast discussion (Figure B-8). This flow allowed the transport of particulate matter from fires in Mexico to the Edinburg East Freddy Gonzales Drive monitor. The observed sounding from Corpus Christi, Texas shows a strong subsidence inversion around 950 mb indicating downward movement of air, which kept any particulate from dissipating (Figure A-29). Light to medium smoke levels are present over South Texas (Figure A-30).

Figure 2-11: *Percentage of Fire Instances Reported by the Mexican government, on and around April 4, 2023*, shows the reported fires in Mexico, with approximately 75% not likely to recur (intentional, hunting, campfires, and smokers).

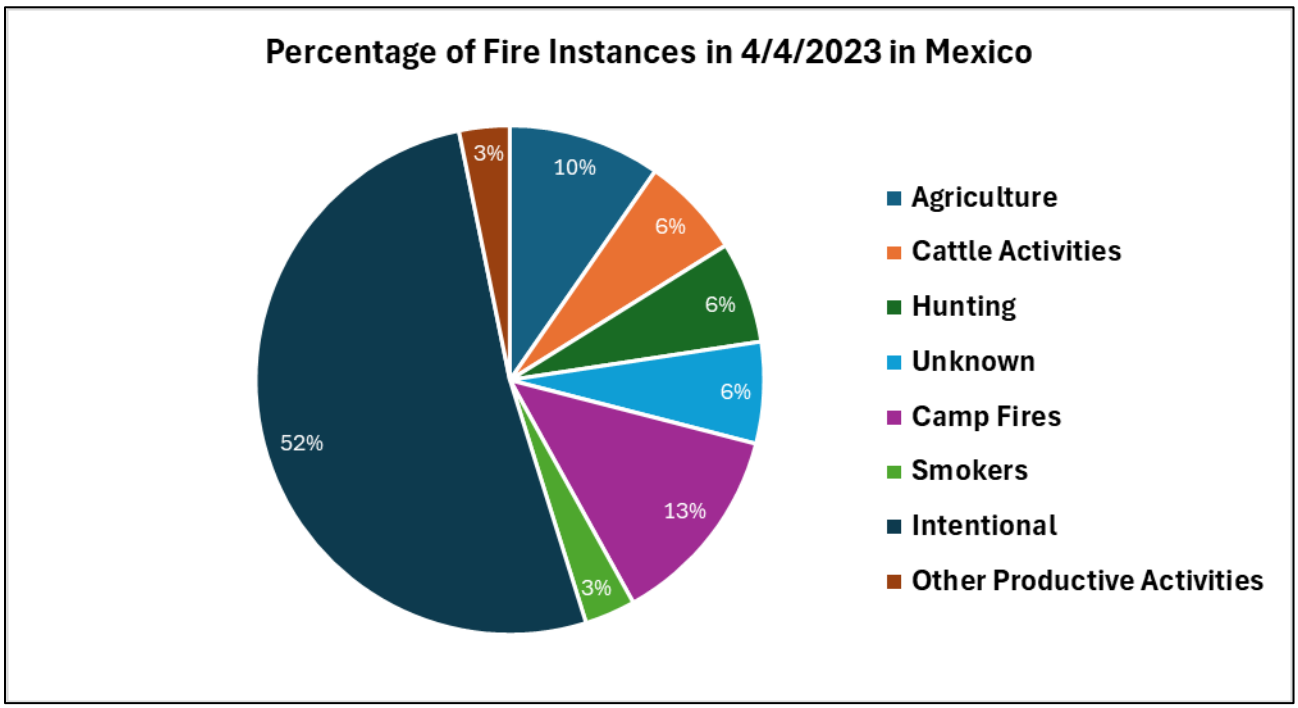

Figure 2-11: Percentage of Fire Instances Reported by the Mexican government, on and around April 4, 2023

2.6.6 Group 6 – Summary of April 15, 2023, Fire (Mexico/Central America) $PM_{2.5}$ Event for the Edinburg East Freddy Gonzalez Drive Monitor

The Edinburg East Freddy Gonzalez Drive monitor measured elevated levels of $PM_{2.5}$ on April 15, 2023, as seen in Figure 2-12: *Hourly $PM_{2.5}$ Concentrations on Days around Event (April 15, 2023) for the Edinburg East Freddy Gonzalez Drive Monitor*. The elevated concentrations were due to smoke from fires in Mexico.

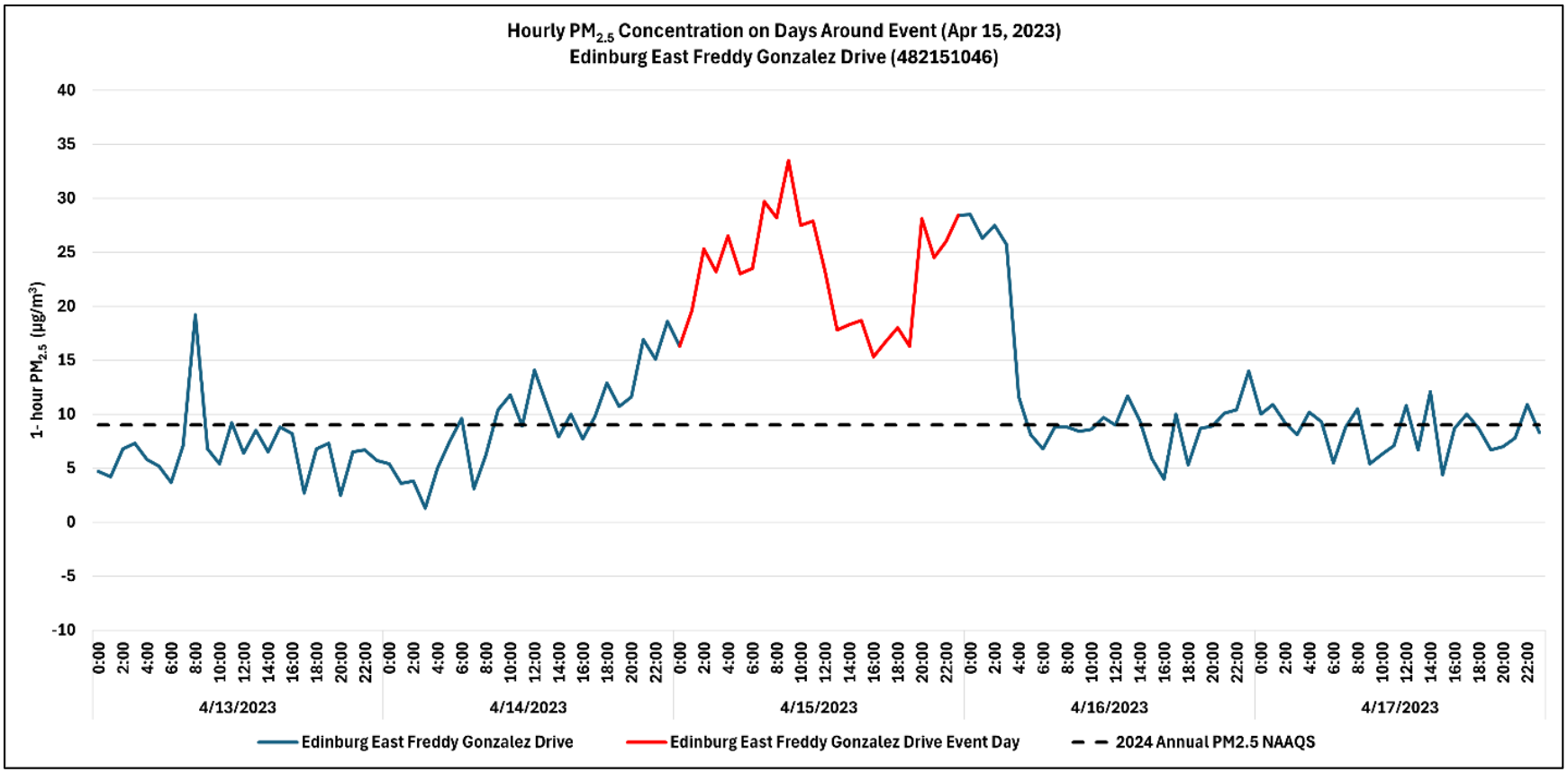

Figure 2-12: Hourly $PM_{2.5}$ Concentrations on Days around Event (April 15, 2023) for the Edinburg East Freddy Gonzalez Drive Monitor

On April 15, 2023, southeasterly winds were present in South Texas, with wind speeds around 10 knots (Figure A-31). The NWS forecast discussion mentioned that wind speeds were forecasted to stay elevated, bringing in southeasterly winds to the area (Figure B-9). A dry line extended over Central Texas ahead of a cold front. There was an upper-level trough digging over the central U.S. with flow from the southwest over Texas, as seen on the 500 mb map (Figure A-32). The observed sounding from Brownsville, Texas shows a strong radiation inversion at the surface with a very dry lower atmosphere (Figure A-33). This indicates subsidence and downward movement of air, impeding any particulate matter from dissipating into the upper atmosphere. Light to medium smoke levels were present over South Texas from fires in Mexico (Figure A-34).

Figure 2-13: *Percentage of Fire Instances Reported by the Mexican Government, on and around April 15, 2023*, shows the reported fires in Mexico, with approximately 68% not likely to recur (intentional, hunting, and campfires).

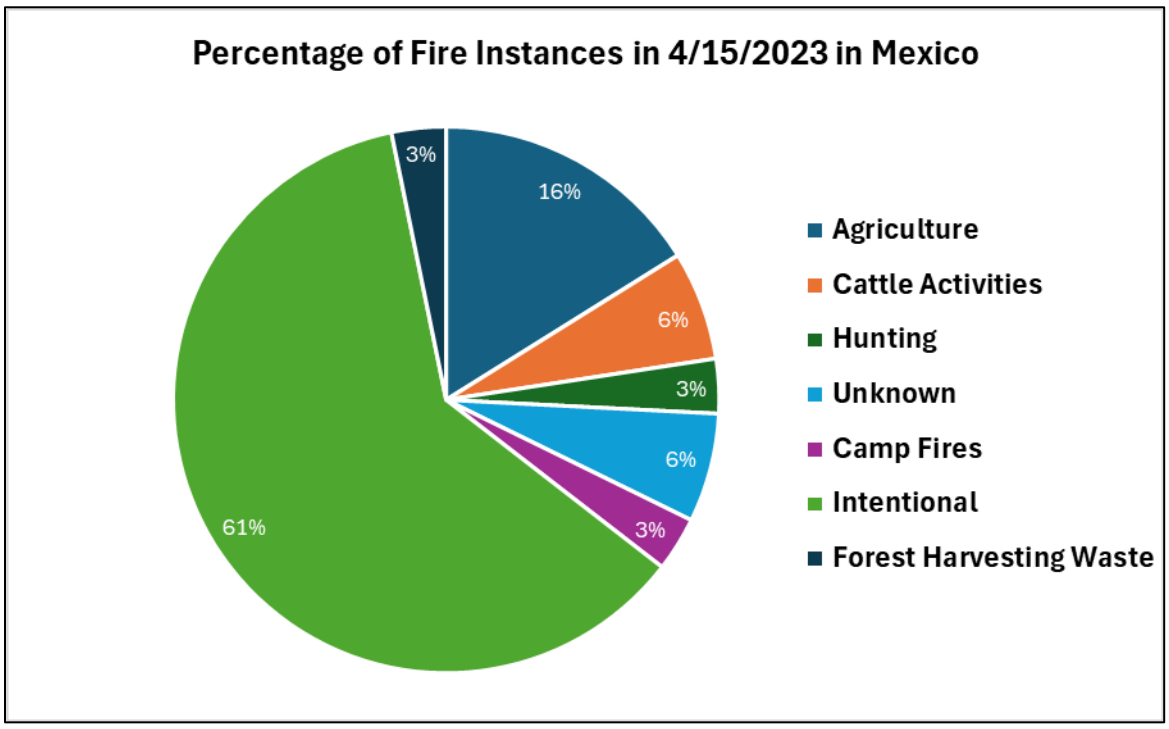

Figure 2-13: Percentage of Fire Instances Reported by the Mexican Government, on and around April 15, 2023

2.6.7 Group 7 – Summary of May 5 and May 6, 2023, Fire (Mexico/Central America) $PM_{2.5}$ Event for the Edinburg East Freddy Gonzalez Drive, World Trade Bridge, and Von Ormy Highway 16 Monitors

Elevated $PM_{2.5}$ levels were measured at the Edinburg East Freddy Gonzalez Drive and World Trade Bridge monitors on May 5, 2023, due to fires in Mexico. The fires also caused elevated $PM_{2.5}$ concentrations on May 6, 2023, at the Edinburg East Freddy Gonzalez Drive, World Trade Bridge, and Von Ormy Highway 16 monitors. Hourly $PM_{2.5}$ concentrations at these monitors can be seen in Figure 2-14: *Hourly $PM_{2.5}$ Concentrations on Days around Event (May 5-6, 2023) for the Edinburg East Freddy Gonzalez Drive, World Trade Bridge, and Von Ormy Highway 16 Monitors.*

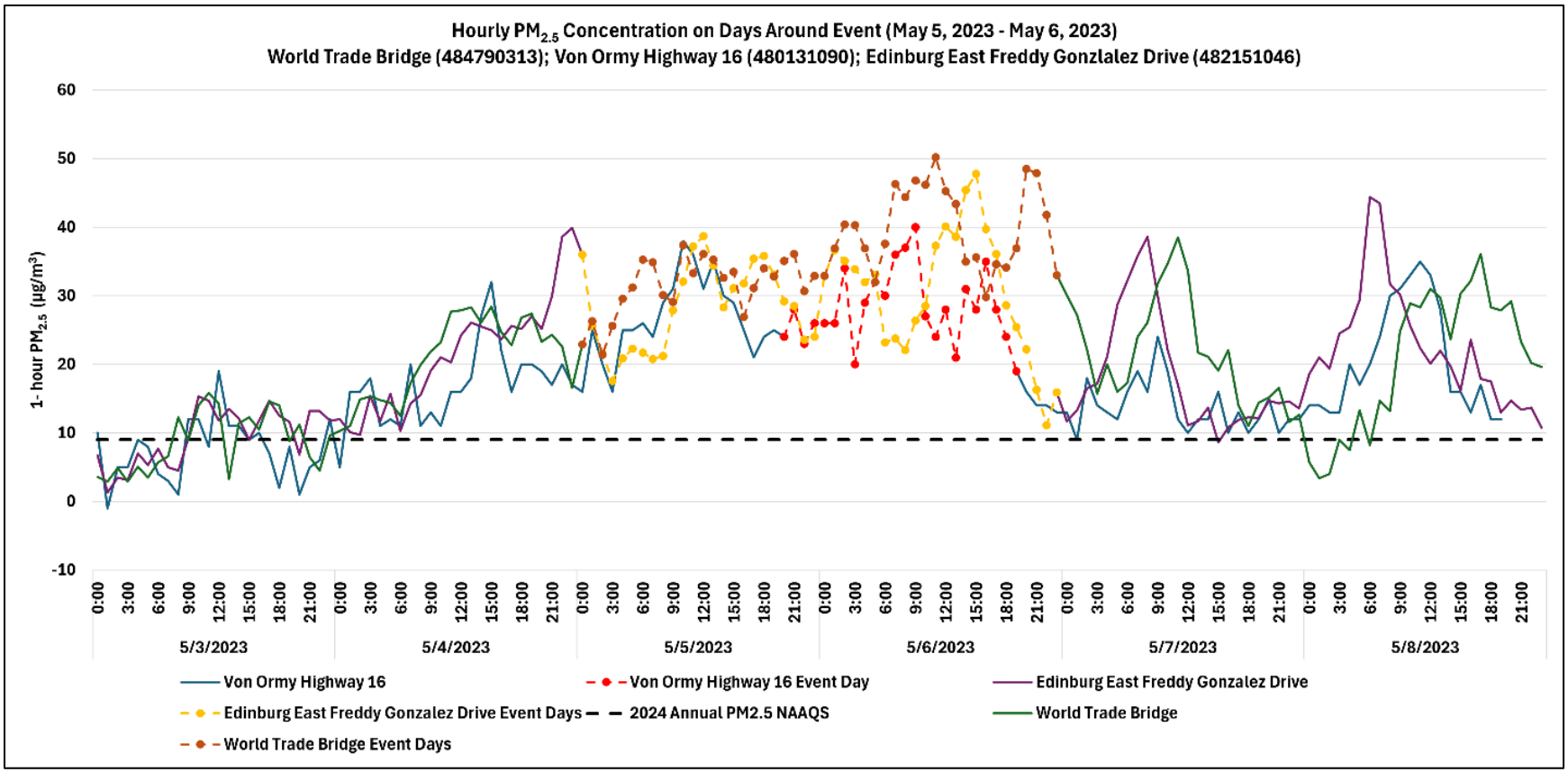

Figure 2-14: Hourly $PM_{2.5}$ Concentrations on Days around Event (May 5-6, 2023) for the Edinburg East Freddy Gonzalez Drive, World Trade Bridge, and Von Ormy Highway 16 Monitors

The South Texas area saw winds out of the south-southeast on May 5, 2023, as shown on the surface weather map (Figure A-35). The 500 mb heights chart on this day (Figure A-36) shows slight ridging over southern and South-Central Texas with flow from the southwest in Southern Texas. This ridging was forecasted to maintain warm, humid, breezy, and hazy conditions in South Texas, as detailed in the NWS forecast discussion (Figure B-10). Medium smoke levels were indicated over South Texas, while light smoke levels were seen over Central Texas (Figure A-38). The lowest levels of the May 5 Corpus Christi atmospheric sounding (Figure A-37) indicated light veering winds near the surface allowing for some stagnation in the area and persistence of smoky air at the ground level.

On May 6, light surface winds continued out of the southeast onto the Texas coast, while a dry line persisted over west Texas (Figure A-39). A zonal pattern was present in Texas in the upper levels (Figure A-40), with strong southerly winds in the lower atmosphere (Figure A-41). Hazy conditions continued across the area due to fires in Mexico, as described in the NWS forecast discussion (Figure B-11), and the light to medium smoke levels are seen across Mexico and Central/South Texas in the HMS smoke layer map (Figure A-42).

Figure 2-15: *Percentage of Fire Instances Reported by the Mexican Government, on and around May 5-6, 2023,* shows the reported fire types in Mexico on and around this exceptional event day.

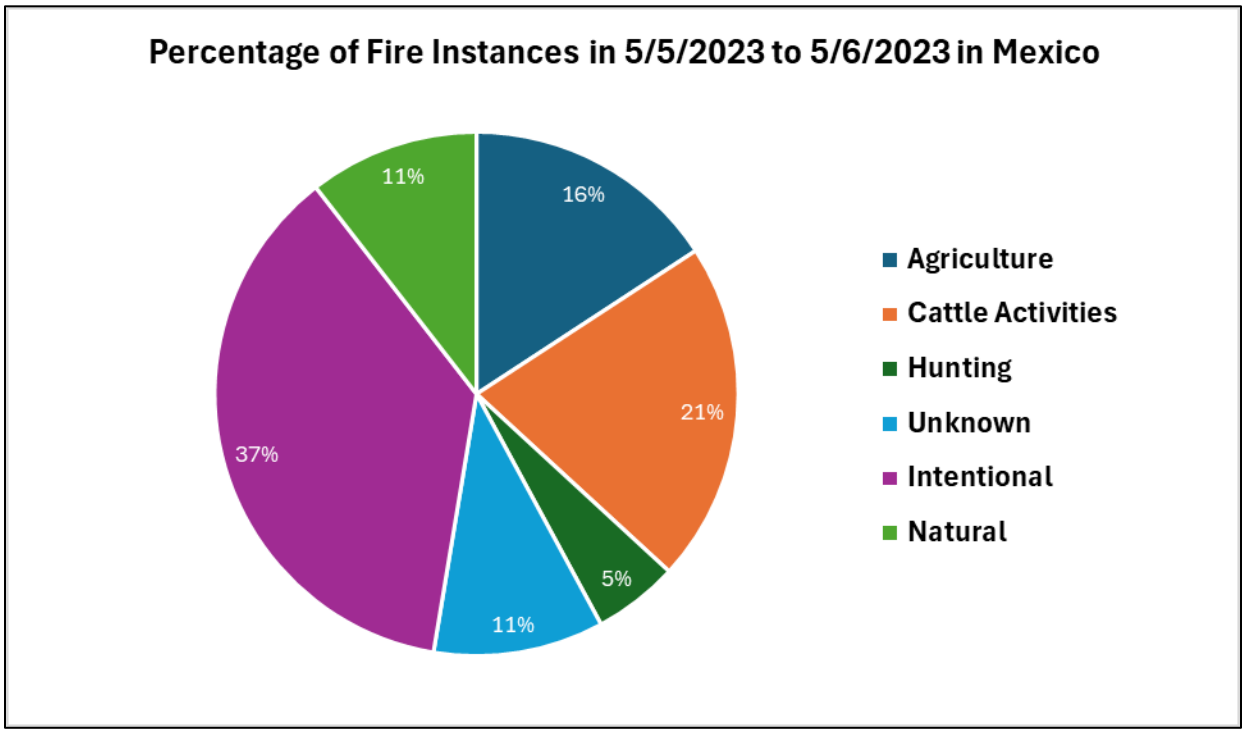

Figure 2-15: Percentage of Fire Instances Reported by the Mexican Government, on and around May 5-6, 2023

2.6.8 Group 8 – Summary of May 11 and May 12, 2023, Fire (Mexico/Central America) $PM_{2.5}$ Event for the Edinburg East Freddy Gonzalez Drive, Haws Athletic Center, and World Trade Bridge Monitors

On May 11, high $PM_{2.5}$ concentrations were measured at the Edinburg East Freddy Gonzalez Drive monitor due to smoke from fires in Mexico. The smoke also contributed to high levels of

$PM_{2.5}$ on May 12, at the Edinburg East Freddy Gonzalez Drive, Haws Athletic Center, and World Trade Bridge monitors. Hourly $PM_{2.5}$ concentrations at these monitors around event days can be seen in Figure 2-16: *Hourly $PM_{2.5}$ Concentrations on Days around Event (May 11-12, 2023) for the Edinburg East Freddy Gonzalez Drive, Haws Athletic Center, and World Trade Bridge Monitors*.

On May 11, 2023, there was an upper-level low pressure system troughing over the Rocky Mountains, with a low height center over New Mexico, as seen on the 500 mb map (Figure A-44). This low height center stacked down to the surface as a cold front over West Texas (Figure A-43). This low-pressure system influenced the flow over Texas to be from the southwest at this level, which was able to transport smoke from fires in Mexico toward the monitors in Central and South Texas. Light to medium smoke levels are seen in the HMS smoke layer map in South Texas (Figure A-45).

Weather conditions stayed about the same on May 12, with the cold front remaining stationary over the Texas panhandle and surface winds continued out of the southeast across most of the state (Figure A-46). The upper-level low pressure system moved over the Midwest, while a zonal pattern existed across the state (Figure A-47). This allowed strong winds at lower levels to transport smoke into Texas from the south/southeast (Figure A-48). Medium levels of smoke over Central/South Texas can be seen on the NOAA HMS Smoke map (Figure A-49).

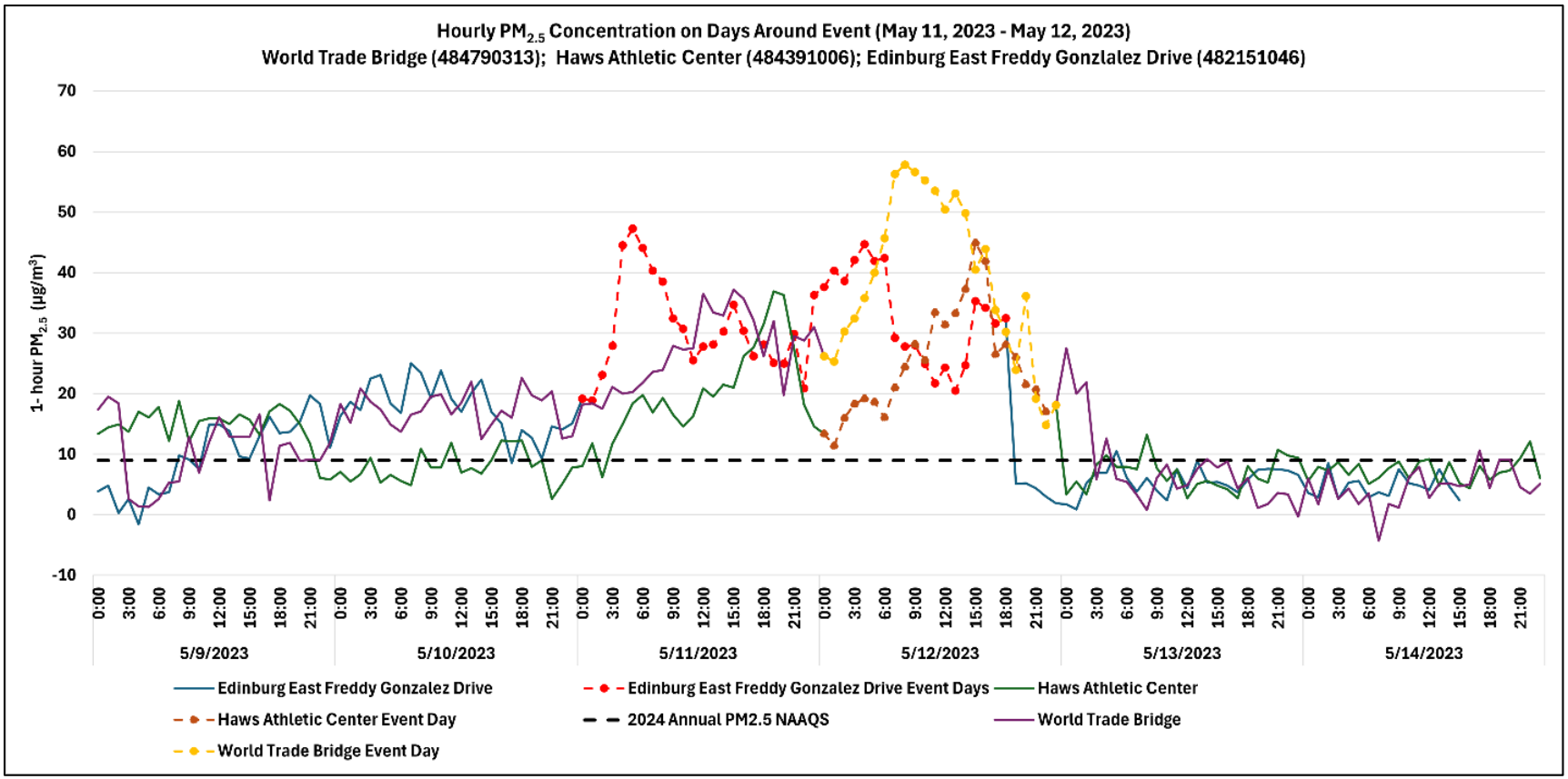

Figure 2-16: Hourly $PM_{2.5}$ Concentrations on Days around Event (May 11-12, 2023) for the Edinburg East Freddy Gonzalez Drive, Haws Athletic Center, and World Trade Bridge Monitors

Figure 2-17: *Percentage of Fire Instances Reported by the Mexican Government, on and around May 11-12, 2023*, shows the reported fires in Mexico, with approximately 40% not likely to recur (intentional, hunting, campfires, and natural cause).

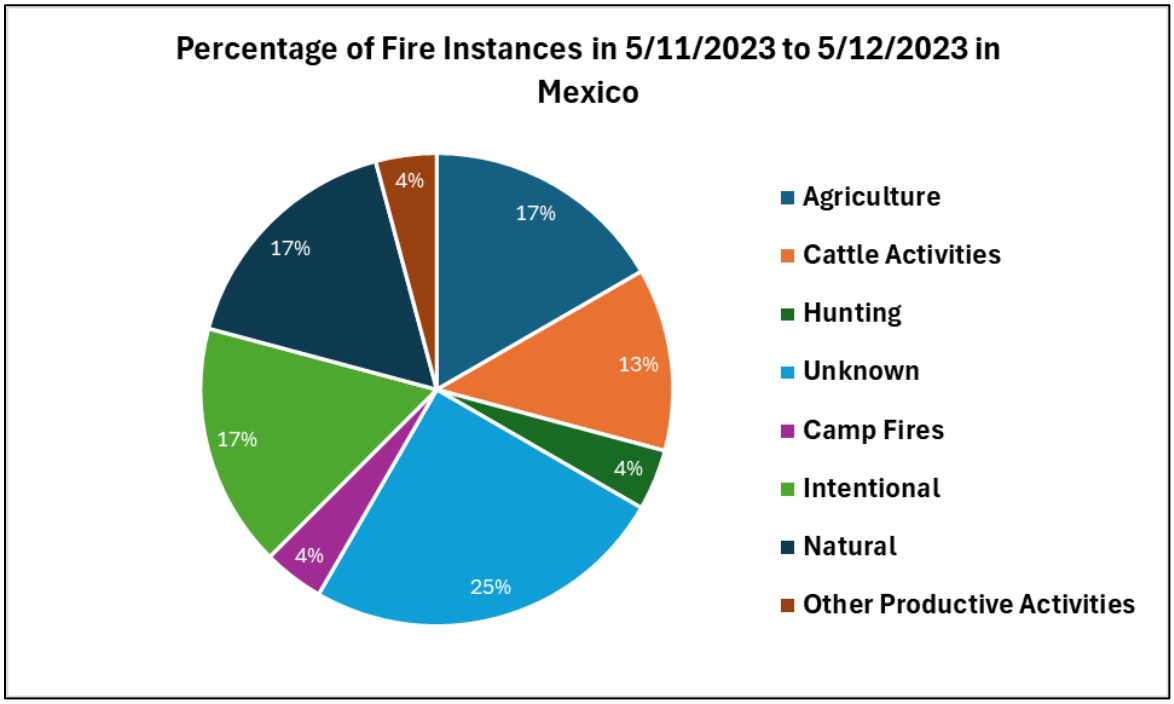

Figure 2-17: Percentage of Fire Instances Reported by the Mexican Government, on and around May 11-12, 2023

2.6.9 Group 9 – Summary of June 14, June 15, and June 16, 2023, Fire (Mexico/Central America) $PM_{2.5}$ Event for the Haws Athletic Center and World Trade Bridge Monitors

The Haws Athletic Center monitor measured elevated $PM_{2.5}$ concentrations on June 14, 2023, due to smoke from fires in Mexico. This monitor, along with the World Trade Bridge monitor, continued to measure high concentrations on June 15, 2023, due to smoke from fires in Mexico. The World Trade Bridge monitor continued to measure high concentrations on June 16, 2023, as smoke persisted in South Texas due to fires in Mexico. The hourly concentrations over these three days can be seen in Figure 2-18: *Hourly $PM_{2.5}$ Concentrations on Days around Event (June 14-16, 2023) for the Haws Athletic Center and World Trade Bridge Monitors*.

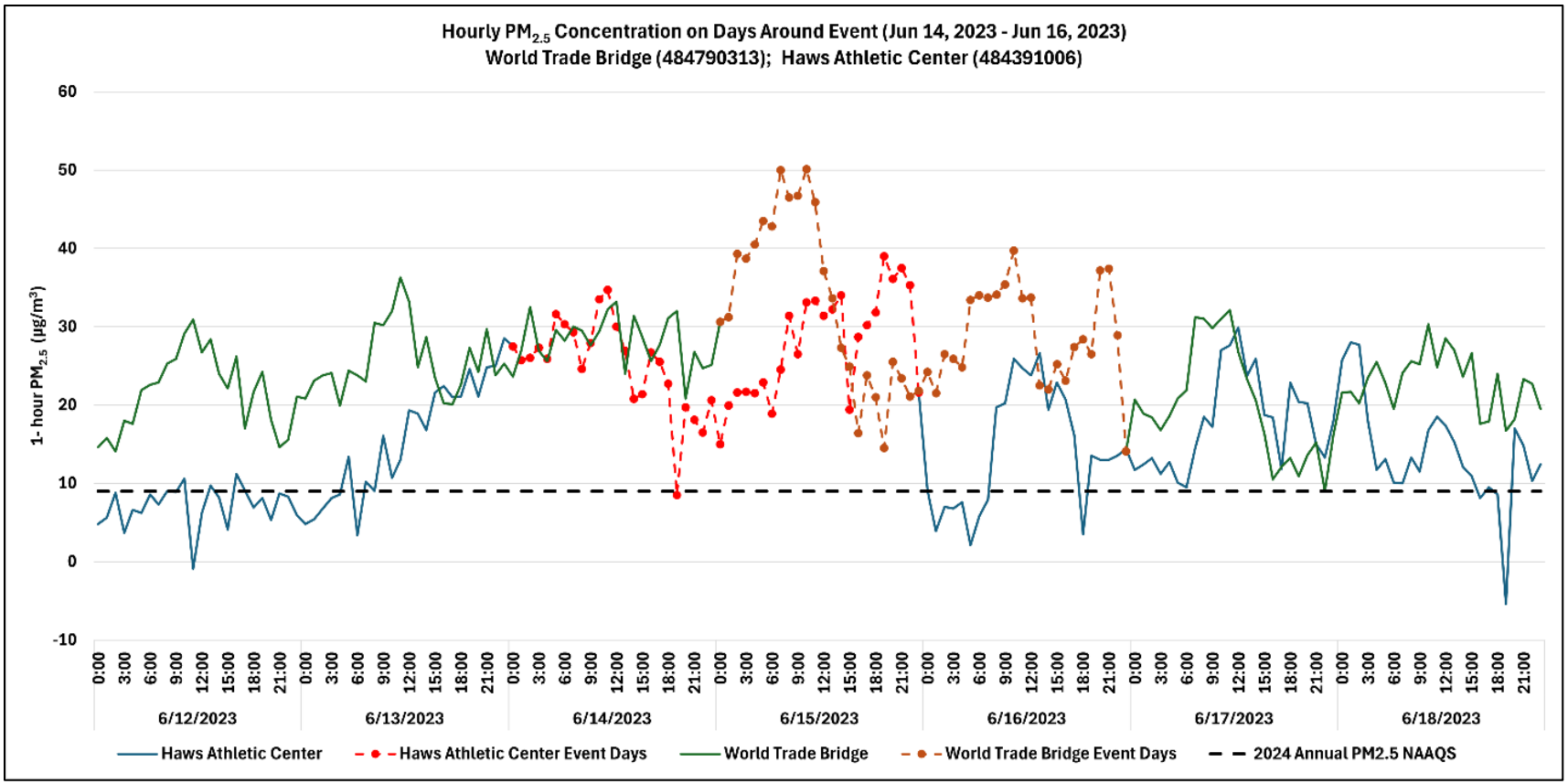

Figure 2-18: Hourly $PM_{2.5}$ Concentrations on Days around Event (June 14-16, 2023) for the Haws Athletic Center and World Trade Bridge Monitors

On June 14, 2023, a warm front extended across North Texas at the surface, with winds out of the southeast behind the front (Figure A-50). The next day, on June 15, the front moved slightly north and became stationary (A-54). Surface winds continued as the day before as the stationary front drifted south the next day on June 16 (A-58). The sounding charts (from Fort Worth, Texas and Brownsville, Texas) on all three days indicate subsidence over Texas due to the presence of subsidence inversions on each day (Figures A-52, A-56, A-60). Subsidence likely brought stability to the lower atmosphere and kept any particulate matter from dissipating into the upper atmosphere. This is corroborated by the weak ridging seen on the 500 mb charts over Texas (Figures A-51, A-55, A-59). The stability across all three days likely trapped any smoke or particulate matter in the lower atmosphere. This is corroborated by the NWS forecast discussion for June 14, which describes hazy conditions due to smoke from fires in Mexico and high relative humidity values in South Texas (Figure B-12). Light-to-medium levels of smoke were indicated over most of the state, including the subject monitoring areas, on all three days in the HMS fire and smoke maps (Figures A-53, A-57, and A-61).

Figure 2-19: *Percentage of Fire Instances Reported by the Mexican Government, on and around June 14-16, 2023*, shows the reported fire types in Mexico on these event days, with around half of the reported fires considered unlikely to recur.

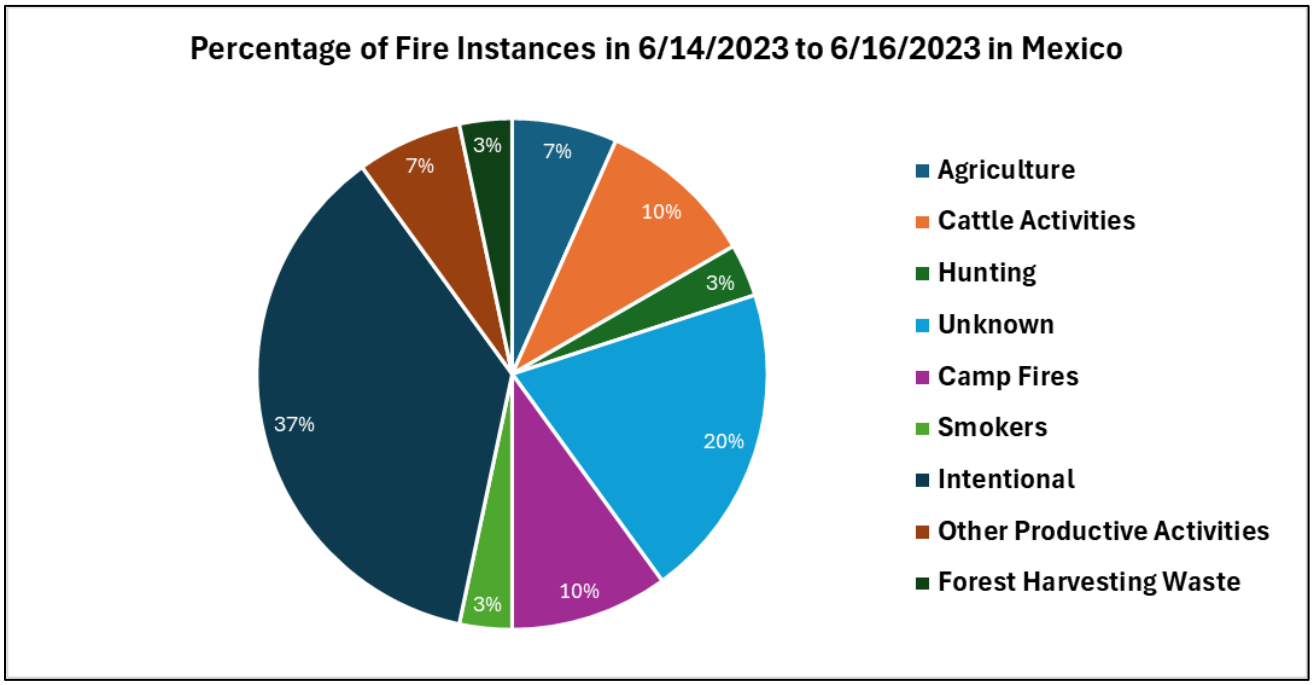

Figure 2-19: Percentage of Fire Instances Reported by the Mexican Government, on and around June 14-16, 2023

2.6.10 Group 10 – Summary of July 15 and July 16, 2023, African Dust Event for the Edinburg East Freddy Gonzalez Drive Monitor

High concentrations of $PM_{2.5}$ were measured at the Edinburg East Freddy Gonzalez Drive monitor on July 15 and 16, due to Saharan dust. The hourly $PM_{2.5}$ concentrations on these two days can be seen in Figure 2-20: *Hourly $PM_{2.5}$ Concentrations on Days around Event (July 15-16, 2023) for the Edinburg East Freddy Gonzalez Drive Monitor.*

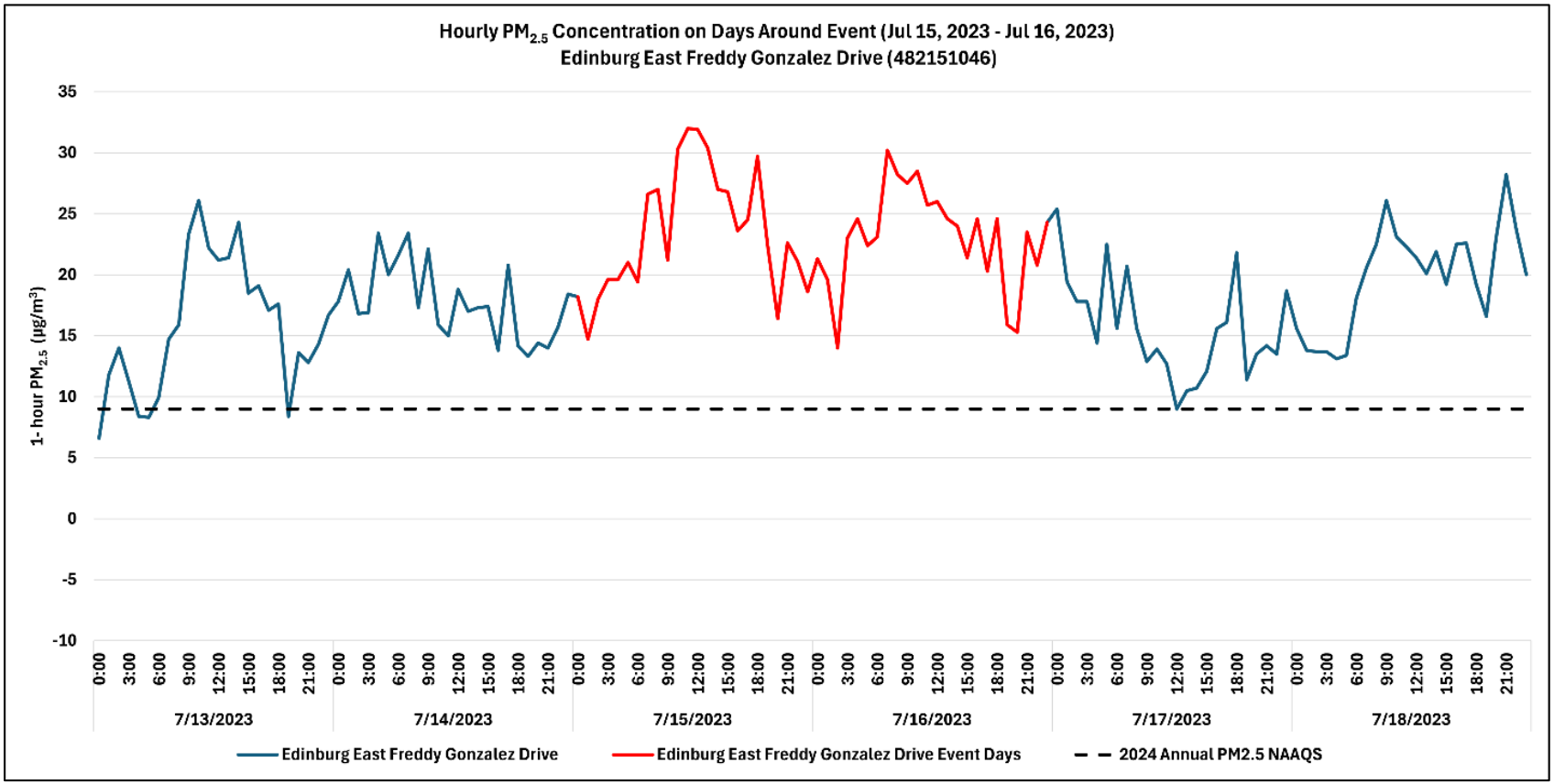

Figure 2-20: Hourly $PM_{2.5}$ Concentrations on Days around Event (July 15-16, 2023) for the Edinburg East Freddy Gonzalez Drive Monitor

South Texas saw light winds from the Gulf of America, as depicted in the July 15 surface weather map (Figure A-62). An area of high pressure is also present over the eastern Gulf of America, with the high pressure system imparting southerly surface winds in South Texas. The 500 mb heights chart on July 15 (Figure A-63) indicates mid-level winds from the east to the west over the coastal bend and South Texas along with east-to-west winds at the mid-level over southern Florida. This east-to-west flow at the mid-levels aids in the transport plumes of Saharan dust across from the Atlantic Ocean, across the Caribbean and the Gulf of America and into the coastal bend and southern portions of Texas. The Brownsville atmospheric sounding from July 15 (Figure A-64) shows winds out of the south at the surface and backing winds (indicating subsidence or sinking air) out of the east in the mid-levels. The Brownsville sounding also depicts a deep layer of dry air at the upper-levels. This dry layer, along with the winds out of the east, are both associated with a Saharan air layer present in the area.

Weather conditions on July 16 were similar to July 15. Winds along the coast at the surface were light out of the southeast (Figure A-65). The 500 mb heights chart for July 16 (Figure A-66) shows the flow from east to west continuing at the mid-levels over the coastal bend and South Texas areas. The sounding at Brownsville on July 16 (Figure A-67) also continues to show a deep layer of dry air just above the surface along with backing southerly winds at the surface transitioning to easterly around 500 mb. These conditions are typically present when the Saharan air layer is present over Texas.

The NWS forecast discussions for both days mention hazy skies due to Saharan dust and agricultural fires in Mexico (Figures B-13 and B-14).

2.6.11 Group 11 – Summary of July 26 and July 27 African Dust $PM_{2.5}$ Event for the Edinburg East Freddy Gonzalez Drive Monitor

On July 26 and 27, 2023, high concentrations of $PM_{2.5}$ were measured at the Edinburg East Freddy Gonzalez Drive monitor due to transport of Saharan dust into Texas. The hourly $PM_{2.5}$ concentrations on these days can be seen in Figure 2-21: *Hourly $PM_{2.5}$ Concentrations on Days around Event (July 26-27, 2023) for the Edinburg East Freddy Gonzalez Drive Monitor*.

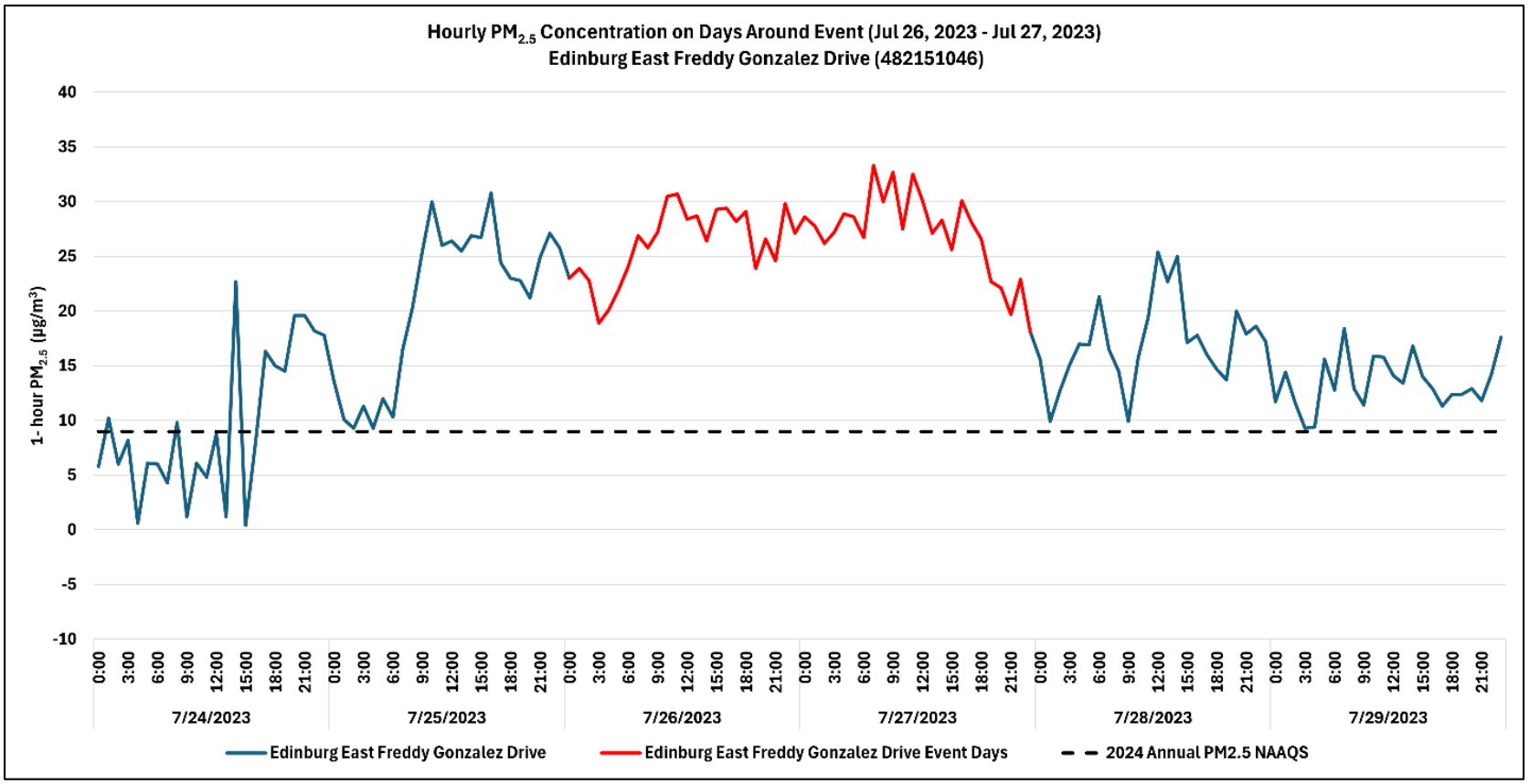

Figure 2-21: Hourly $PM_{2.5}$ Concentrations on Days around Event (July 26-27, 2023) for the Edinburg East Freddy Gonzalez Drive Monitor

On July 26, 2023, high pressure was present over the central and eastern part of Gulf of America, as seen in the July 26 surface weather map (Figure A-68). A weak stationary front was present across the southeast U.S., extending into northeast Texas. Surface monitors near the high-pressure system showed anti-cyclonic circulation around the Gulf of America surface high, transporting Saharan dust into South Texas and the coastal bend. The 500 mb heights chart from July 26, 2023 (Figure A-69) shows a mid-level high pressure system centered over the Four Corners area with ridging seen over the western two-thirds of Texas. The sounding from Brownsville (Figure A-70) indicates winds out of the south in the lower levels, transporting smoke from industrial activity in the Bay of Campeche and Saharan dust from the Gulf of America into South Texas.

A high-pressure system centered over the north-central Gulf continued to be the dominating feature in the area, as seen in the July 27, 2023, surface weather map (Figure A-71). Surface weather observations around the high-pressure system continue to show the anti-cyclonic flow, transporting African dust and smoke associated with industrial activity in the western Gulf of America into South Texas. The Brownsville atmospheric sounding on July 27 (Figure A-72) continues to show southerly flow into the area in the lower layers of the atmosphere, as well as a deep layer of dry air in the mid to upper levels, which combined with the southerly winds, are typically seen when a Saharan air mass is influencing conditions at the monitor. NWS forecast discussions on July 26 and July 28 detail the arrival of the Saharan Air Layer (SAL) and the weather conditions contributing to decreased air quality (Figures B-15, B-16, and B-17).

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, 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.*[9] Tiering thresholds, established for each site, are used to classify event days as Tier 1 or Tier 2 or Tier 3 days. All 2023 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, 2023 Event Days and Tier 1 and Tier 2 Thresholds for the Von Ormy Highway 16 Monitor*, Figure 3-2: *24-Hour $PM_{2.5}$ Concentrations, 2023 Event Days and Tier 1 and Tier 2 Thresholds for the Edinburg East Freddy Gonzalez Drive Monitor*, Figure 3-3: *24-Hour $PM_{2.5}$ Concentrations, 2023 Event Days and Tier 1 and Tier 2 Thresholds for the Fort Worth Northwest Monitor*, Figure 3-4: *24-Hour $PM_{2.5}$ Concentrations, 2023 Event Days and Tier 1 and Tier 2 Thresholds for the Haws Athletic Center Monitor*, and Figure 3-5: *24-Hour $PM_{2.5}$ Concentrations, 2023 Event Days and Tier 1 and Tier 2 Thresholds for the World Trade Bridge Monitor* illustrate the 24-hour $PM_{2.5}$ concentrations on 2023 event days compared to non-event days relative to the Tier levels for each monitor.

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

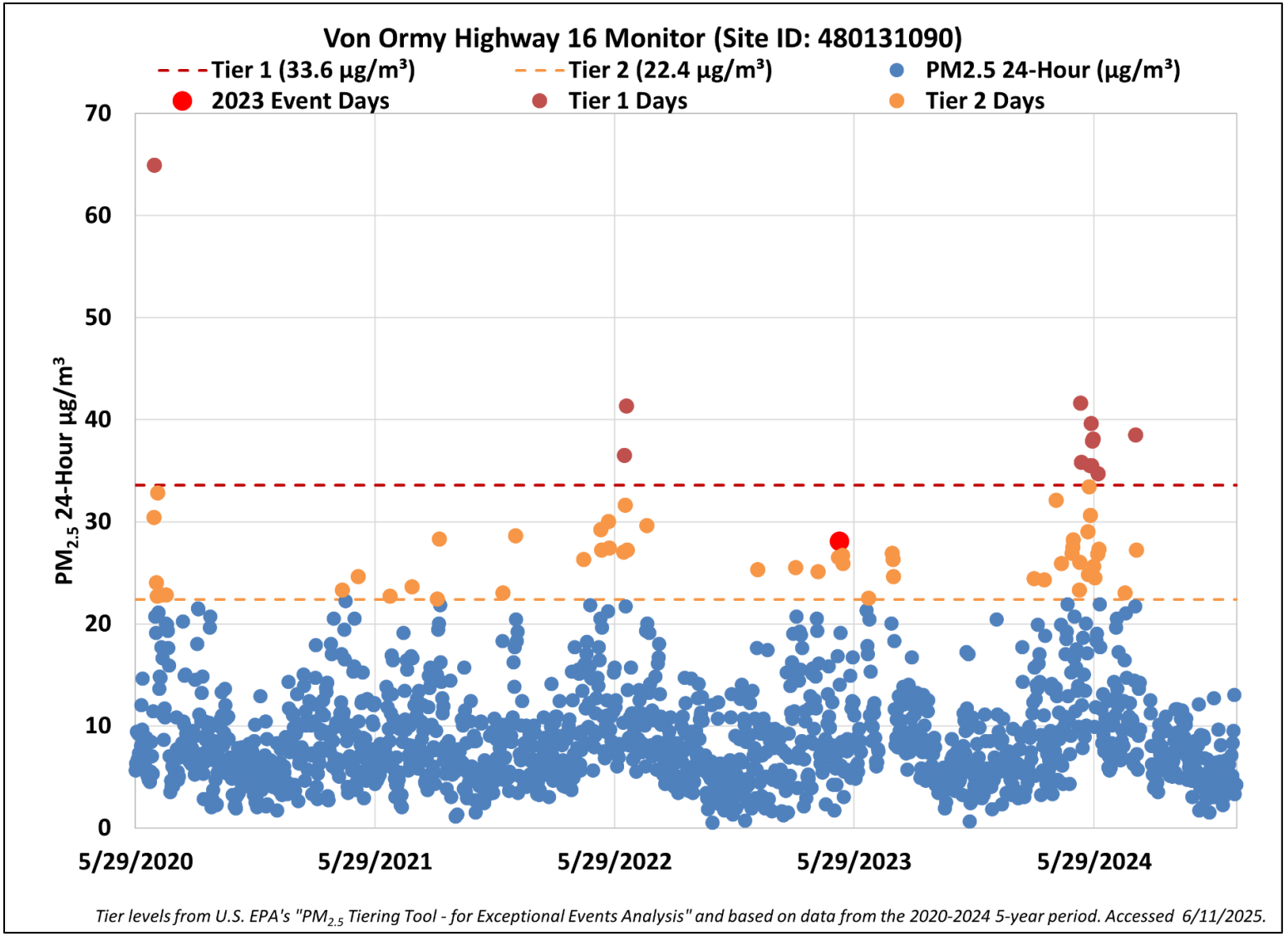

Figure 3-1: 24-Hour $PM_{2.5}$ Concentrations, 2023 Event Days and Tier 1 and Tier 2 Thresholds for the Von Ormy Highway 16 Monitor

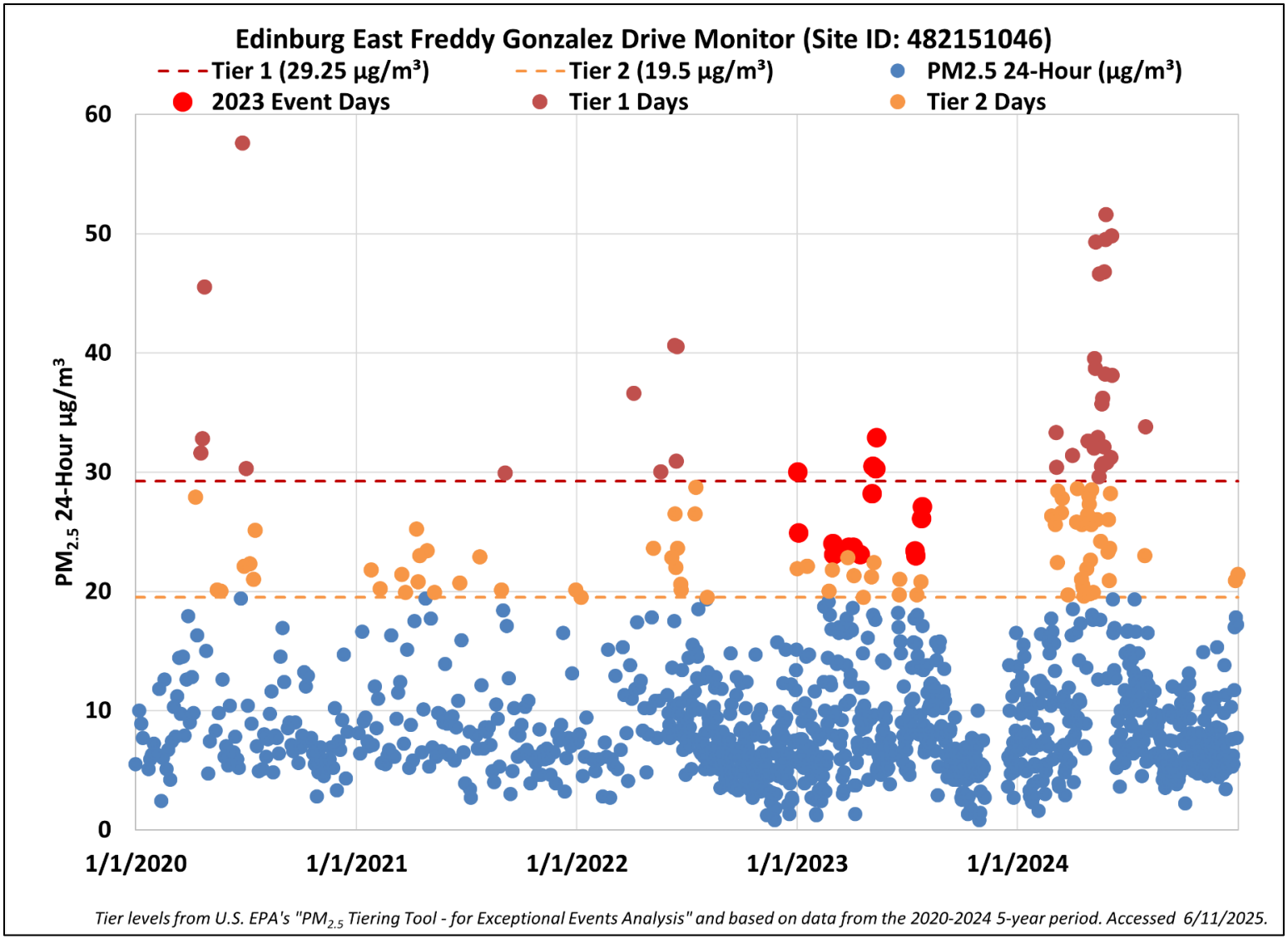

Figure 3-2: 24-Hour $PM_{2.5}$ Concentrations, 2023 Event Days and Tier 1 and Tier 2 Thresholds for the Edinburg East Freddy Gonzalez Drive Monitor

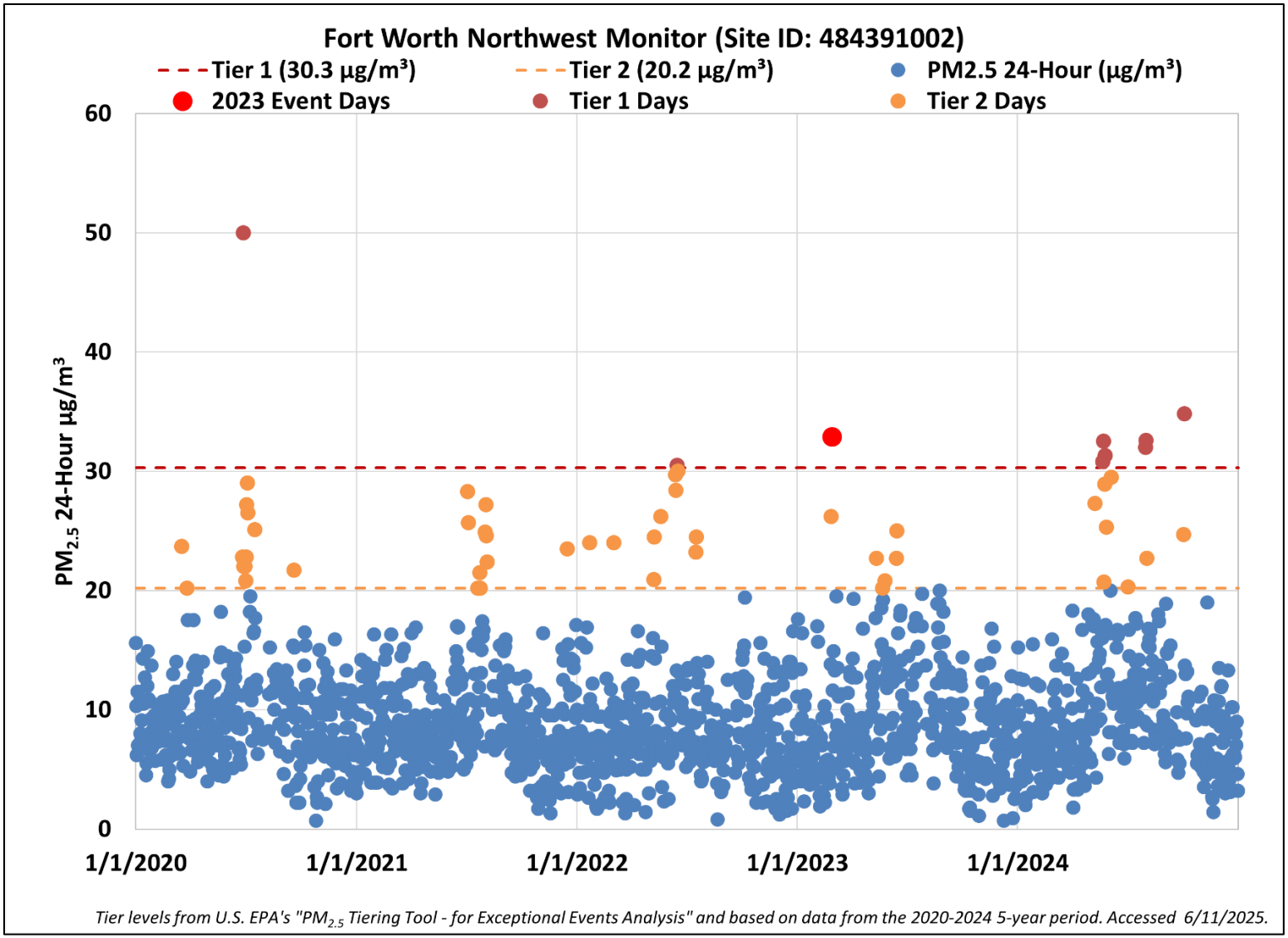

Figure 3-3: 24-Hour $PM_{2.5}$ Concentrations, 2023 Event Days and Tier 1 and Tier 2 Thresholds for the Fort Worth Northwest Monitor

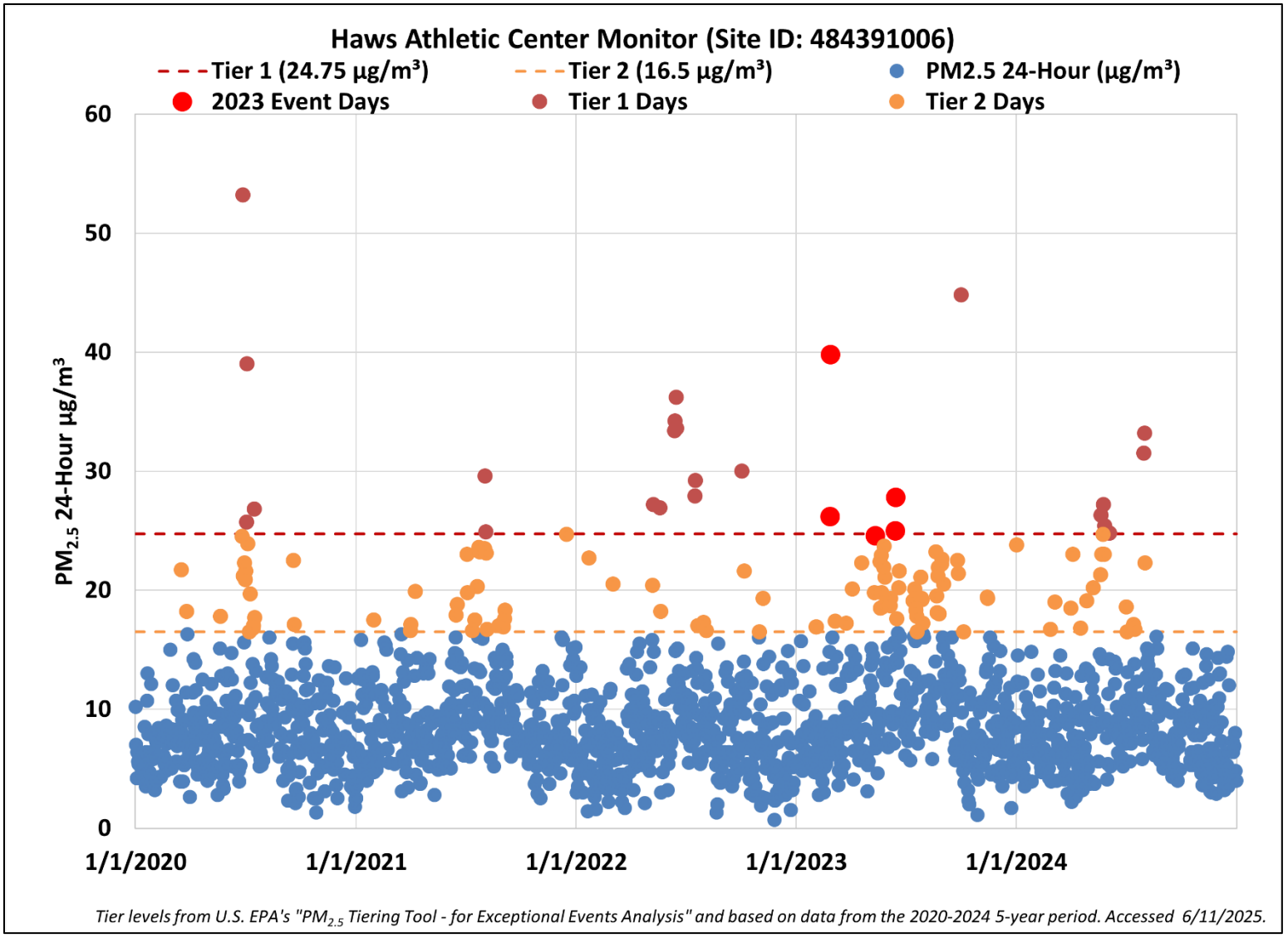

Figure 3-4: 24-Hour $PM_{2.5}$ Concentrations, 2023 Event Days and Tier 1 and Tier 2 Thresholds for the Haws Athletic Center Monitor

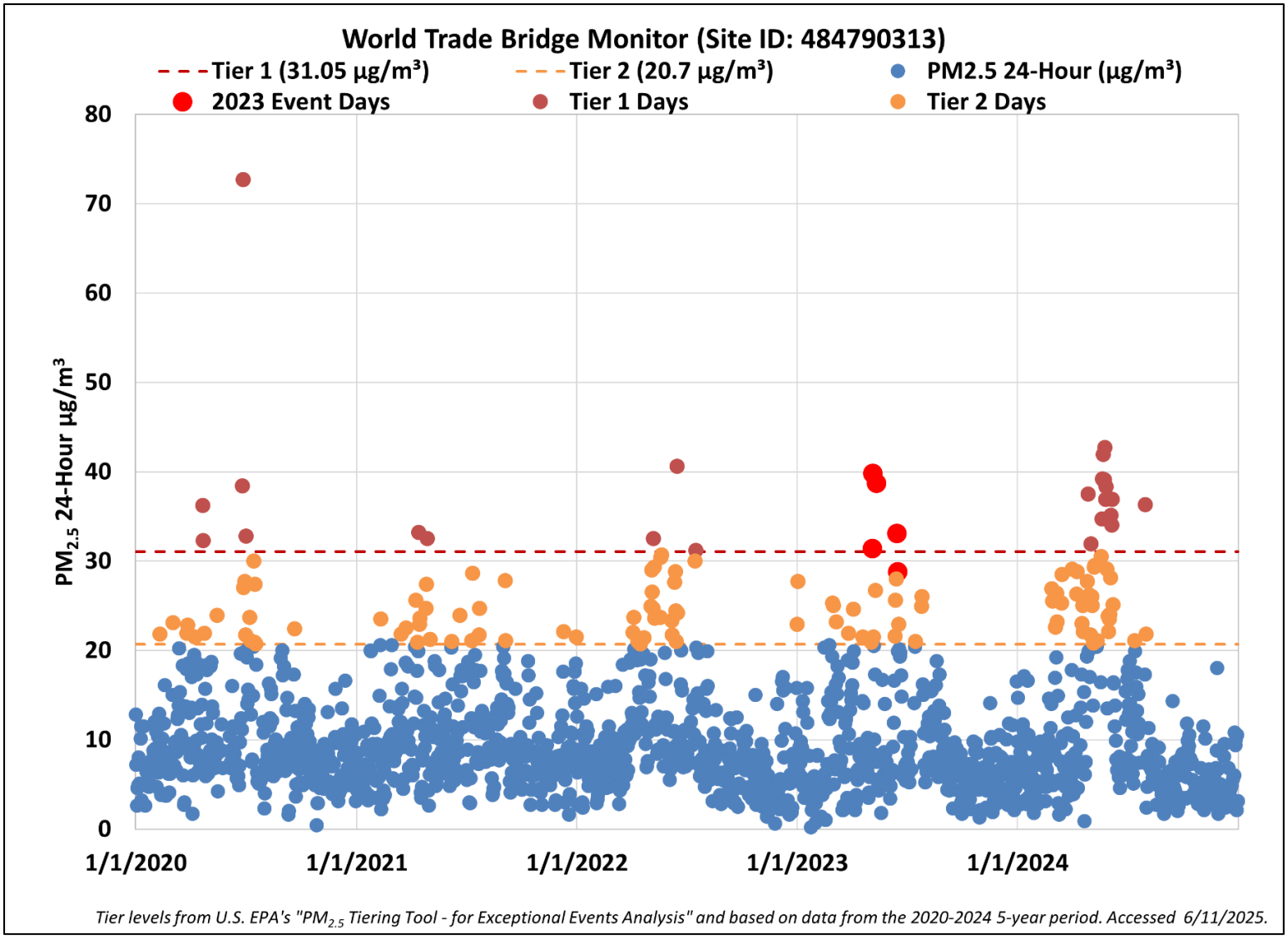

Figure 3-5: 24-Hour $PM_{2.5}$ Concentrations, 2023 Event Days and Tier 1 and Tier 2 Thresholds for the World Trade Bridge Monitor

3.2 CLEAR CAUSAL EVIDENCE

In addition to Figure 3-1, Figure 3-2, Figure 3-3, Figure 3-4, and Figure 3-5, which show 24-hour $PM_{2.5}$ concentrations on event and non-event days at each monitor, additional data are used to demonstrate a clear causal relationship between the $PM_{2.5}$ concentrations observed on an event day and the identified exceptional event. 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, 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 3 median) for each hour. 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 May 22, 2025. 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
- Smoke plume maps are from the AirNow Fire and Smoke Map: https://fire.airnow.gov/.[10] 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/.

[10] 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.

- Satellite imagery from NASA Worldview: https://worldview.earthdata.nasa.gov/ was captured using Corrected Reflectance (True Color) layers from the MODIS (Moderate 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 the January 2 and January 3, 2023, Fire (Mexico/Central America) $PM_{2.5}$ Event for the Edinburg East Freddy Gonzalez Drive Monitor

January 2, 2023, was identified as a Tier 1 day, and January 3 was identified as a Tier 2 day at the Edinburg East Freddy Gonzalez Drive monitor due to smoke from fires in Mexico. On January 2, the 24-hr $PM_{2.5}$ concentration was 30.0 µg/m^3, and the hourly concentrations compared to Tier 3 median concentrations can be seen in *Figure 3-6: Hourly $PM_{2.5}$ Concentrations on January 2, 2023, Compared to Typical Concentrations at the Edinburg East Freddy Gonzalez Drive Monitor.*

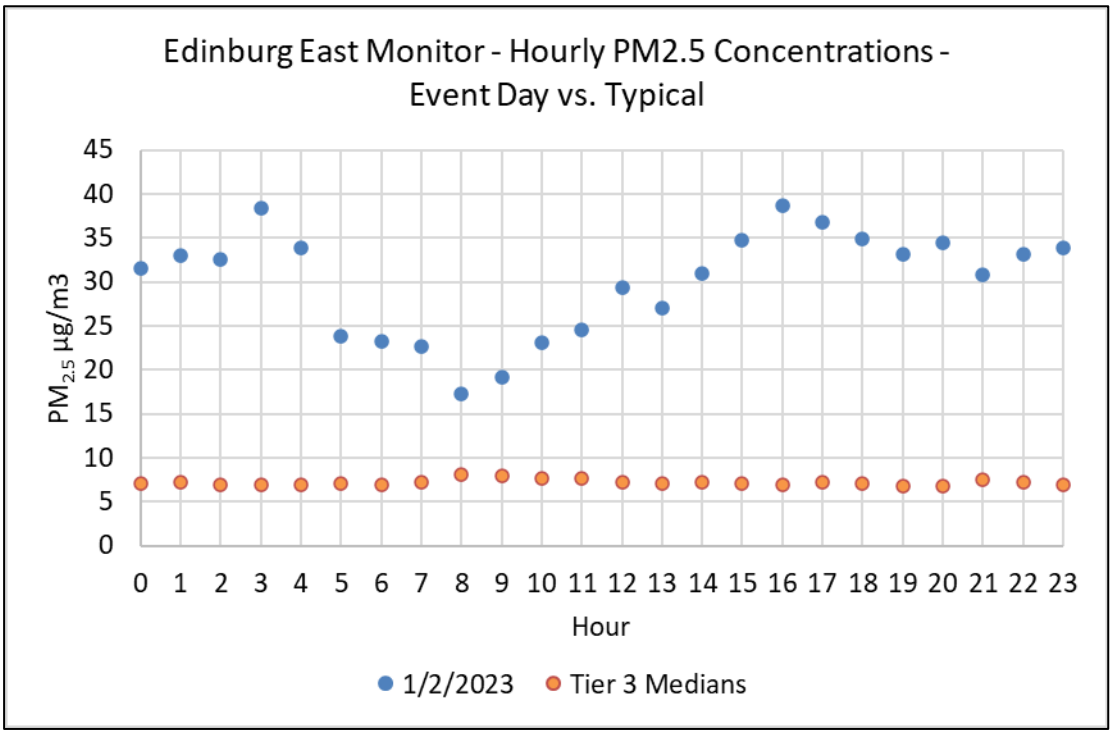

Figure 3-6: Hourly $PM_{2.5}$ Concentrations on January 2, 2023, Compared to Typical Concentrations at the Edinburg East Freddy Gonzalez Drive Monitor

On January 3, the 24-hr $PM_{2.5}$ concentration was 24.9 µg/m^3, and the hourly concentrations compared to Tier 3 median concentrations can be seen in Figure 3-7: *Hourly $PM_{2.5}$ Concentrations on January 3, 2023, Compared to Typical Concentrations at the Edinburg East Freddy Gonzalez Drive Monitor*.

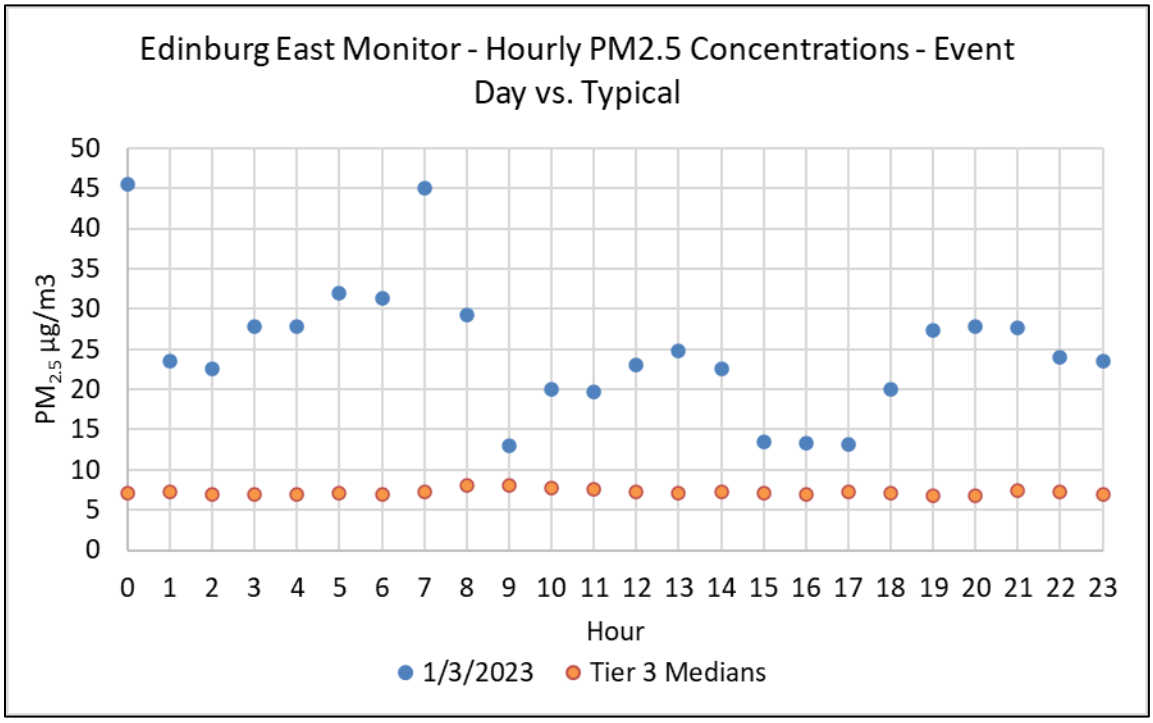

Figure 3-7: Hourly $PM_{2.5}$ Concentrations on January 3, 2023, Compared to Typical Concentrations at the Edinburg East Freddy Gonzalez Drive Monitor

The TCEQ forecast discussion for these two days describe increased fine particulate matter levels associated with fire activity in Mexico and industrial activity in the Bay of Campeche (Table C-1). Back trajectories from the monitor on January 2 and January 3 show that air parcels at different levels pass through areas with fire activity (Figure 3-8: *AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the East Freddy Gonzalez Drive Monitor on January 2, 2023* and Figure 3-9: *AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the East Freddy Gonzalez Drive Monitor on January 3, 2023*).

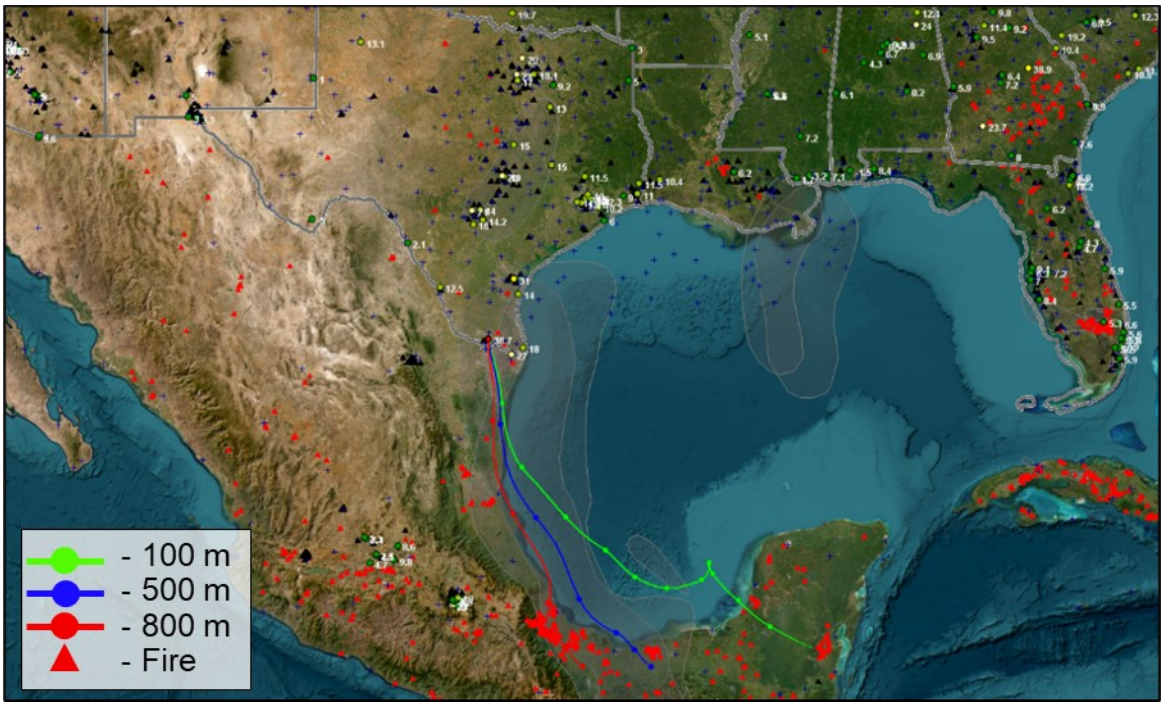

Figure 3-8: AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the East Freddy Gonzalez Drive Monitor on January 2, 2023

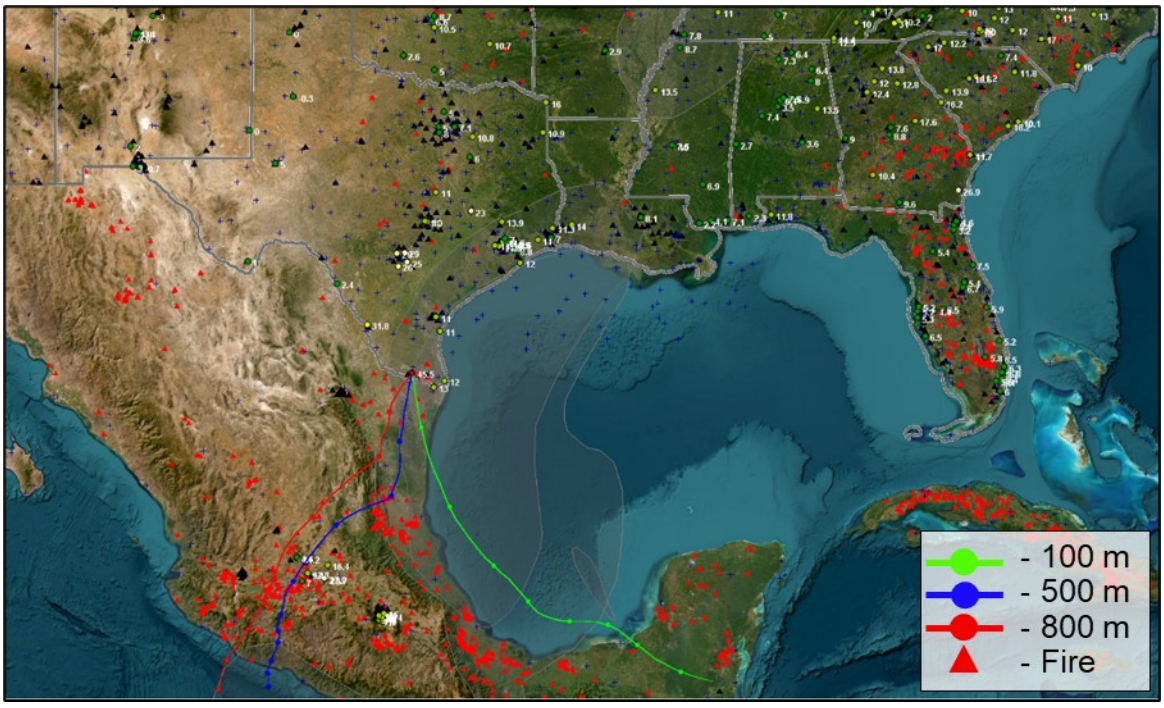

Figure 3-9: AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the East Freddy Gonzalez Drive Monitor on January 3, 2023

For January 3, the AQI along the Texas coast was in the Moderate level due to the smoke (Figure 3-10: *AirNow HMS Smoke Plume for January 3, 2023*). Forward trajectories from Mexico mirrors the smoke level map, showing air movement from fire activity in Mexico moving up to the

Texas coast and into South Texas (Figure 3-11: *NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Mexico Starting on December 31, 2022*).

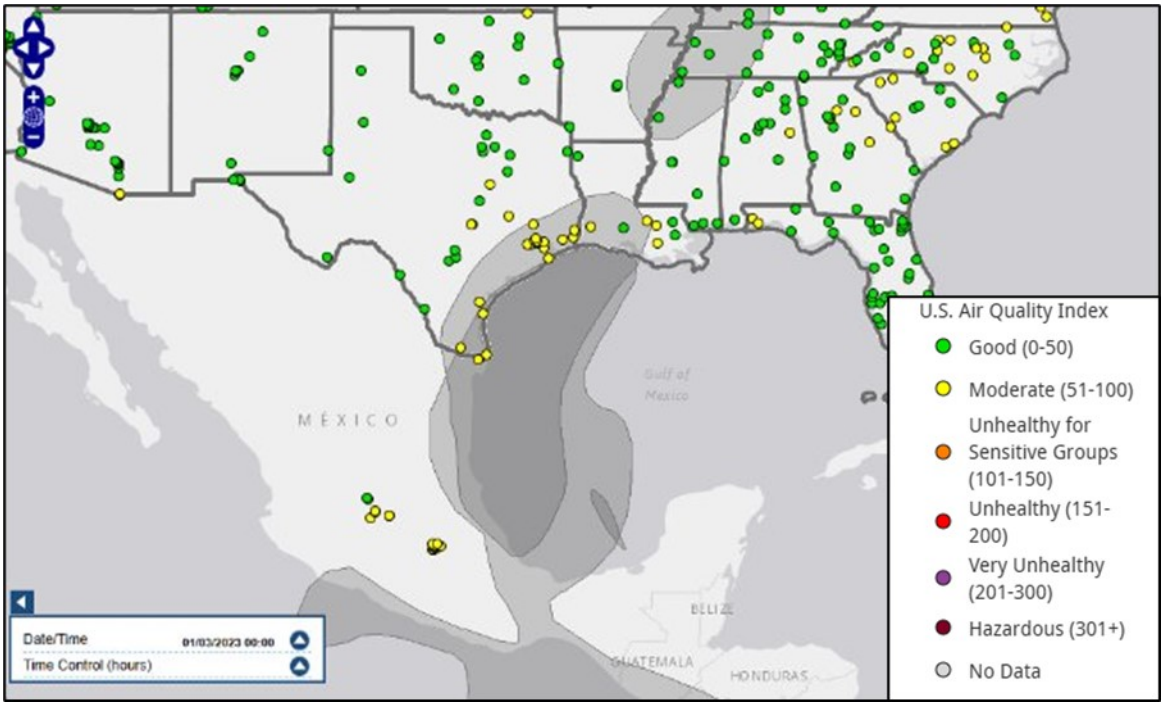

Figure 3-10: AirNow HMS Smoke Plume for January 3, 2023

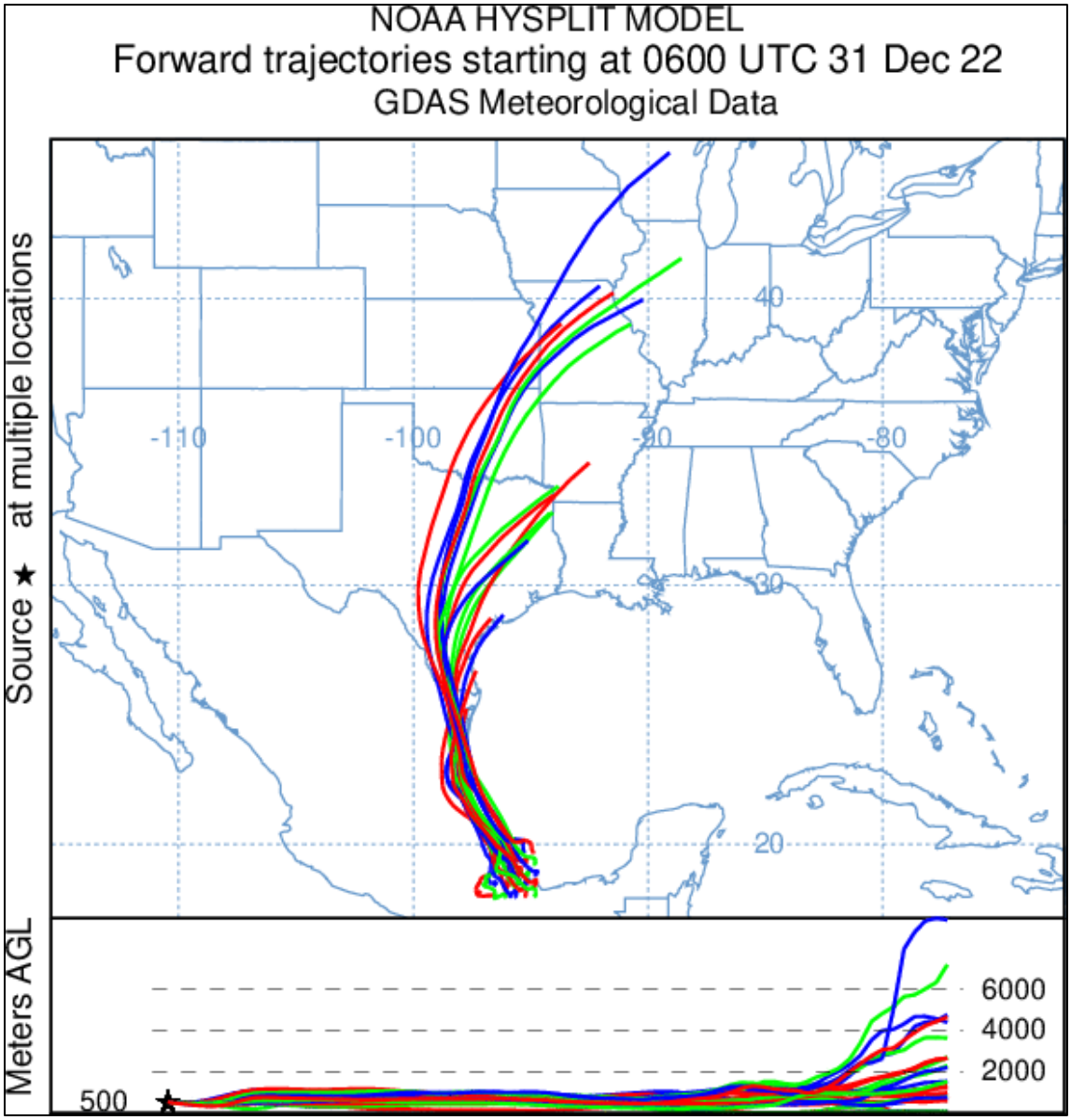

Figure 3-11: NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Mexico Starting on December 31, 2022

3.2.2 Group 2 - Evidence for the February 26 and February 27, 2023, Fire (Mexico/Central America) and High Wind $PM_{2.5}$ Event for the Haws Athletic Center and Fort Worth Northwest Monitors

February 26, 2023, was identified as a Tier 1 day at the Haws Athletic Center monitor. The 24-hr average concentration was 26.2 µg/m^3, and the hourly $PM_{2.5}$ concentrations compared to Tier 3 median values can be seen in Figure 3-12: *Hourly $PM_{2.5}$ Concentrations on February 26, 2023, Compared to Typical Concentrations at the Haws Athletic Center Monitor.*

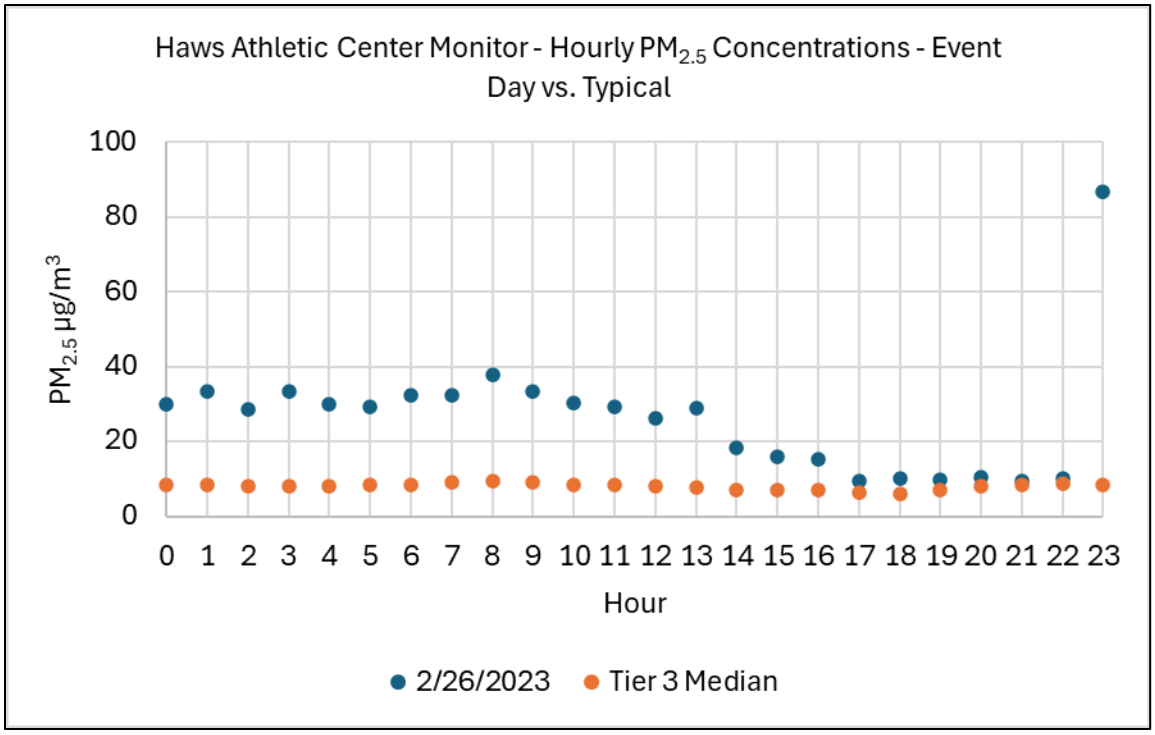

Figure 3-12: Hourly $PM_{2.5}$ Concentrations on February 26, 2023, Compared to Typical Concentrations at the Haws Athletic Center Monitor

The elevated $PM_{2.5}$ concentrations on February 26, 2023, were due to smoke from fires in Mexico and also a dust storm associated with a fast-moving cold front (Table C-2). The back trajectories from the monitor show movement of air through Texas from the Gulf of America (Figure 3-13: *AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the Haws Athletic Center Monitor on February 26, 2023*). When the cold front moved into the area, the accompanying dust storm caused a decrease of air quality and visibility across Texas and was covered in several media reports (Figures C-1, C-2, C-3).

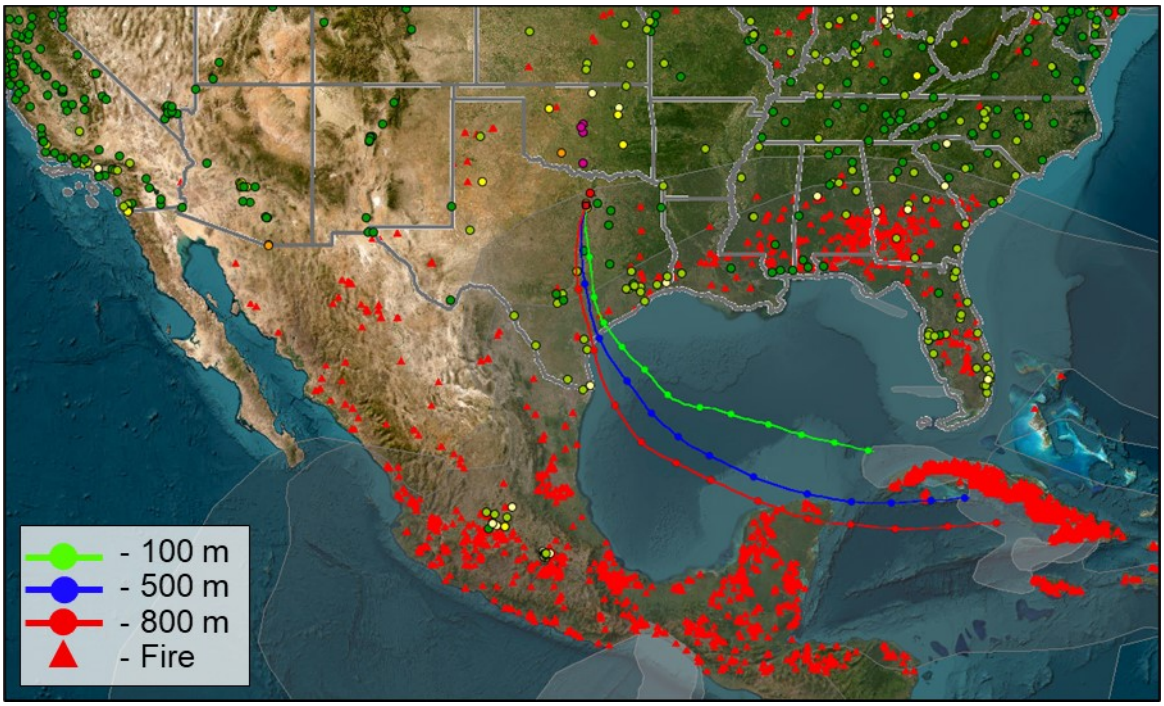

Figure 3-13: AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the Haws Athletic Center Monitor on February 26, 2023

The Haws Athletic Center monitor also measured high concentrations of $PM_{2.5}$ on February 27, 2023, with the highest concentrations occurring from midnight to 2:00 a.m. The 24-hr average concentration was 39.8 µg/m^3, and the hourly concentrations compared to typical values can be seen in Figure 3-14: *Hourly $PM_{2.5}$ Concentrations on February 27, 2023, Compared to Typical Concentrations at the Haws Athletic Center Monitor.*

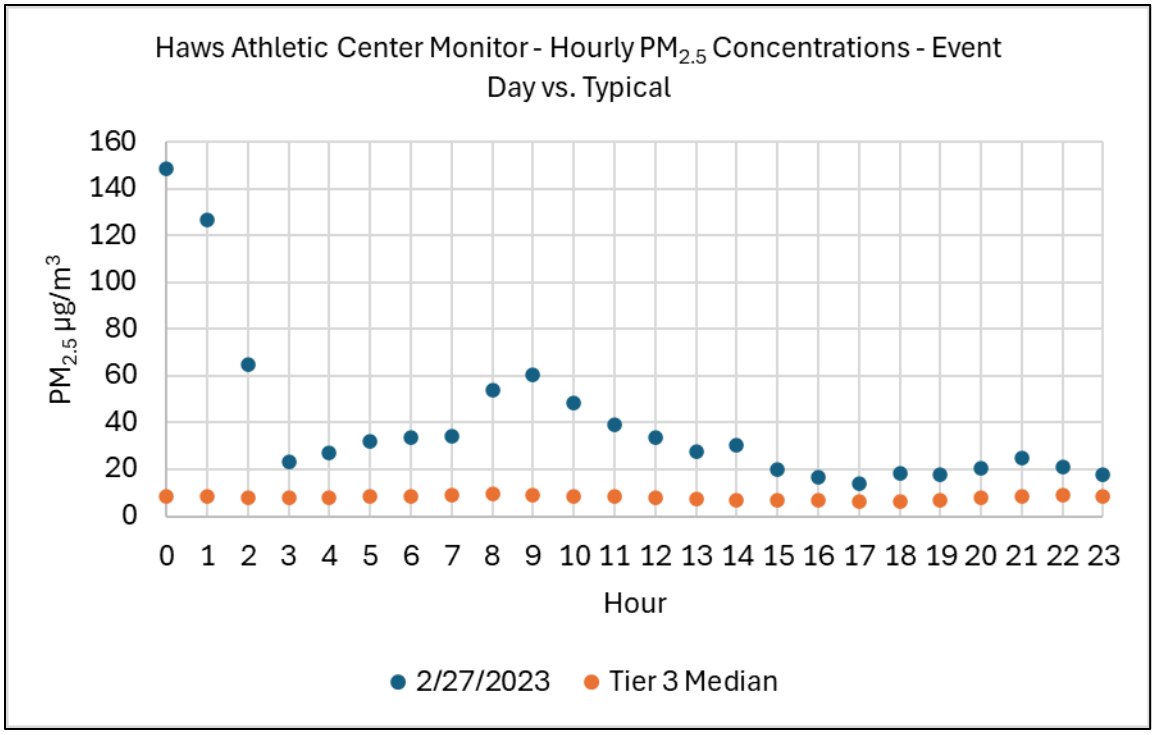

Figure 3-14: Hourly $PM_{2.5}$ Concentrations on February 27, 2023, Compared to Typical Concentrations at the Haws Athletic Center Monitor

The Fort Worth Northwest monitor also measured high $PM_{2.5}$ concentrations on February 27, 2023, with the 24-hr average being 32.9 µg/m^3. The hourly concentrations compared to Tier 3 median values can be seen in Figure 3-15: *Hourly $PM_{2.5}$ Concentrations on February 27, 2023, Compared to Typical Concentrations at the Fort Worth Northwest Monitor.*

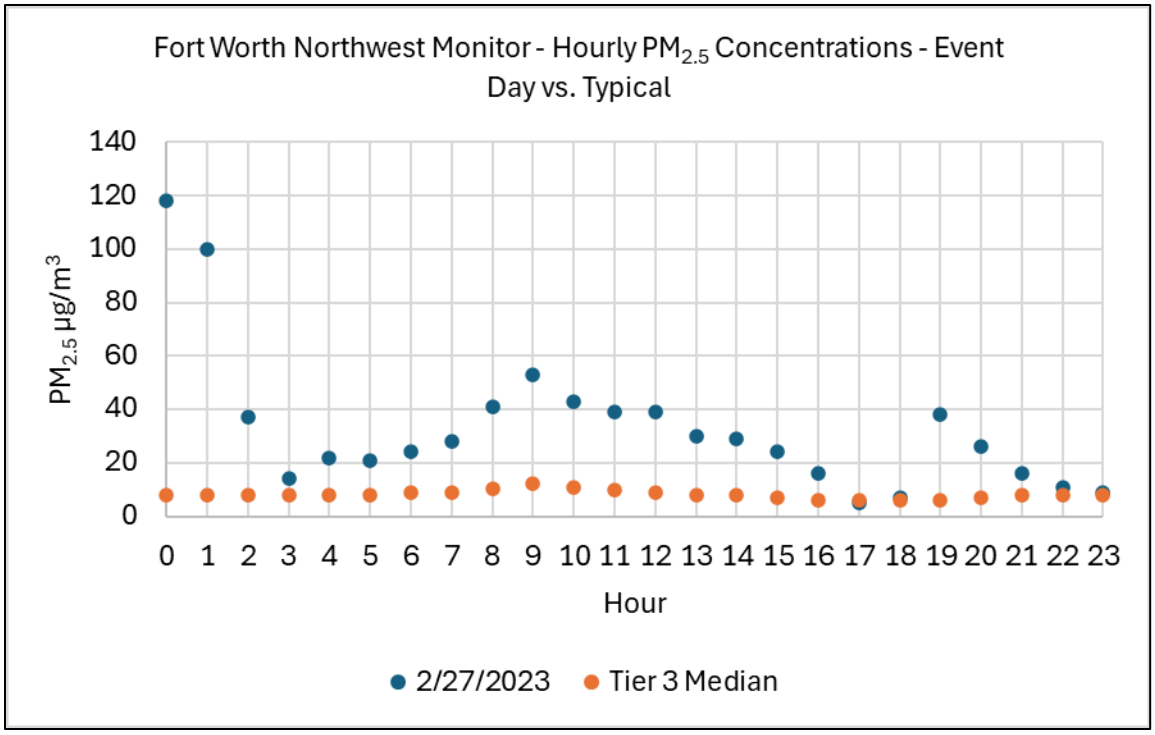

Figure 3-15: Hourly $PM_{2.5}$ Concentrations on February 27, 2023, Compared to Typical Concentrations at the Fort Worth Northwest Monitor

The high $PM_{2.5}$ concentrations at these monitors on February 27 were due to lingering dust caused by the cold front and also due to smoke from fires in Mexico (Table C-2). The back trajectories from this day show transport of air through areas of smoke along the Texas coast and the Gulf (Figure 3-16: *AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the Haws Athletic Center Monitor on February 27, 2023* and Figure 3-17: *AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the Fort Worth Northwest Monitor on February 27, 2023*), and most monitors in the state had Moderate AQI levels due to smoke transport and lingering dust (Figure 3-18: *AirNow HMS Smoke Plume for February 27, 2023*).

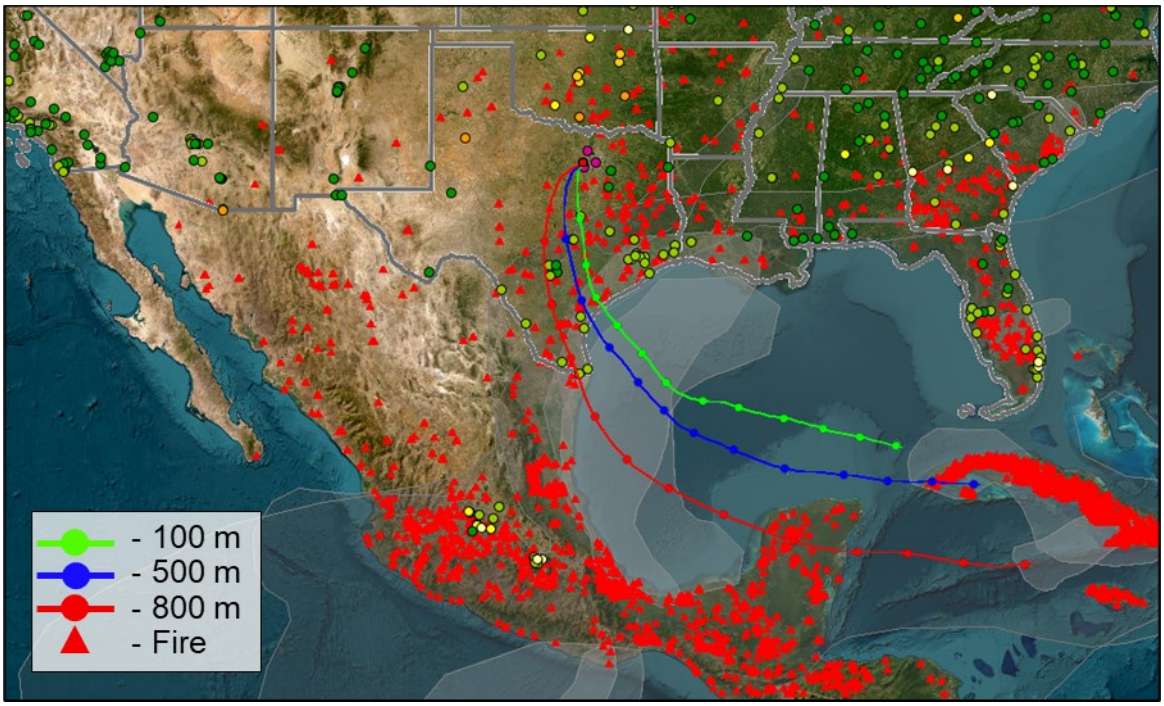

Figure 3-16: AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the Haws Athletic Center Monitor on February 27, 2023

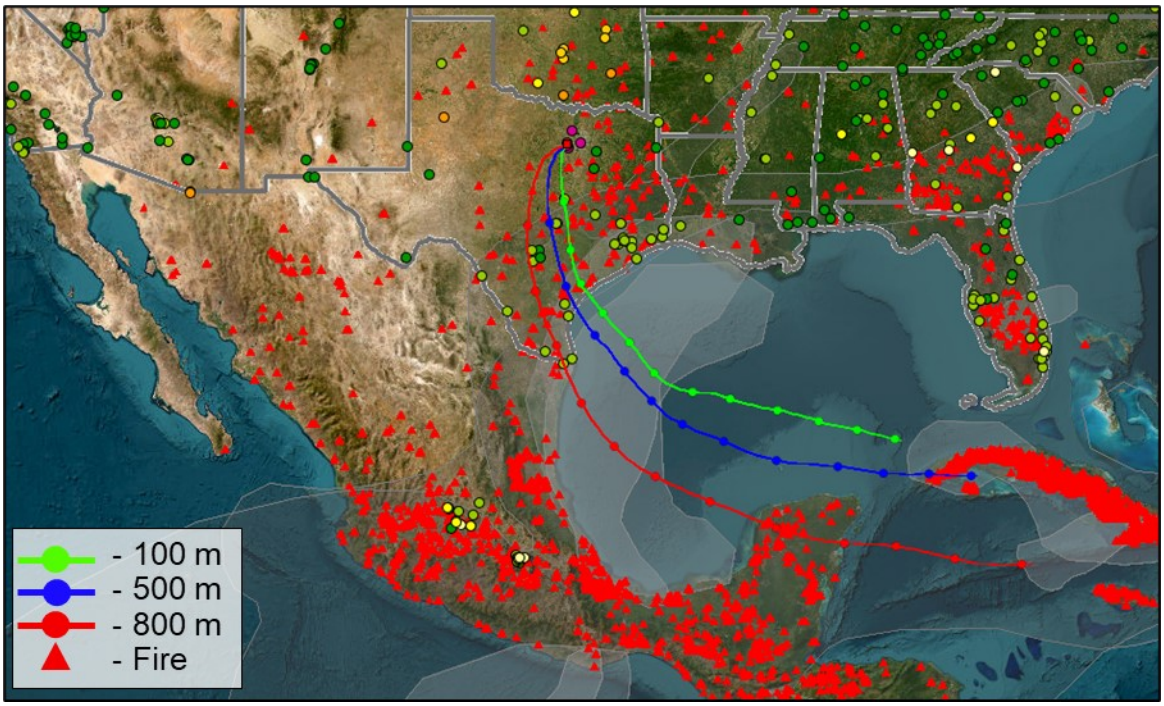

Figure 3-17: AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the Fort Worth Northwest Monitor on February 27, 2023

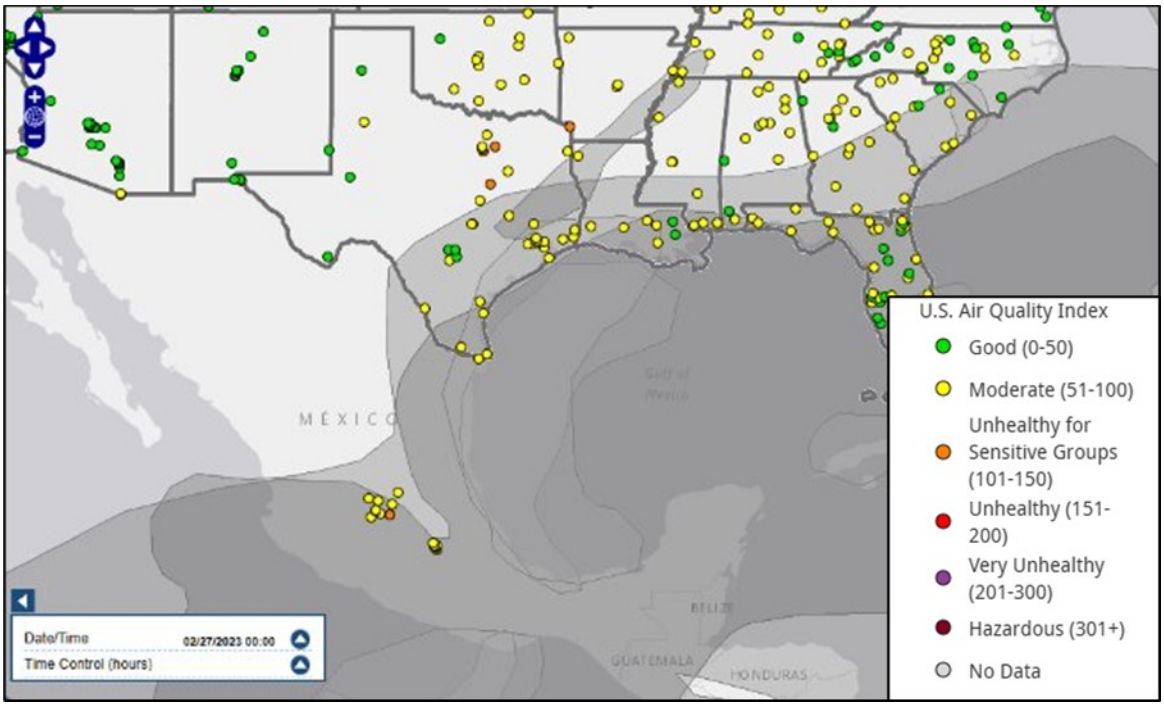

Figure 3-18: AirNow HMS Smoke Plume for February 27, 2023

3.2.3 Group 3 – Evidence for the March 1 and March 2, 2023, Fire (Mexico/Central America) $PM_{2.5}$ Event for the Edinburg East Freddy Conzalez Drive Monitor

March 1 and March 2, 2023, were identified as Tier 2 days for the Edinburg East Freddy Gonzalez Drive monitor due to smoke from fires in Mexico. On March 1, the hourly $PM_{2.5}$ concentrations at the monitor are compared to typical Tier 3 median values in Figure 3-19: *Hourly $PM_{2.5}$ Concentrations on March 1, 2023, Compared to Typical Concentrations at the Edinburg East Freddy Gonzalez Drive Monitor*.

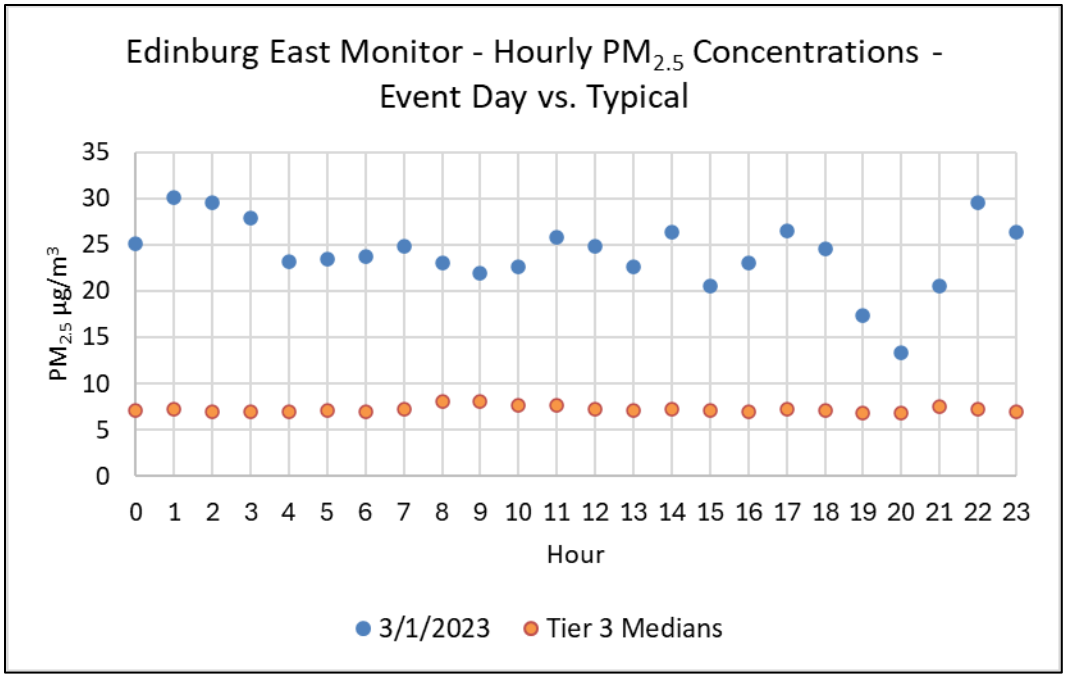

Figure 3-19: Hourly $PM_{2.5}$ Concentrations on March 1, 2023, Compared to Typical Concentrations at the Edinburg East Freddy Gonzalez Drive Monitor

Back trajectories from this monitor pass over areas with fire activity along the coast of Mexico and the Yucatan peninsula (Figure 3-20: *AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the East Freddy Gonzalez Drive Monitor on March 1, 2023*). Moderate AQI levels for $PM_{2.5}$ are seen in South Texas due to the smoke levels (Figure 3-21: *AirNow HMS Smoke Plume for March 1, 2023*), and the TCEQ forecast on this day describes moderate amounts of smoke being steered from Mexico, Central America, and Cuba (Table C-3). Forward trajectories from Mexico confirm the movement of smoke into South Texas from areas with fires (Figure 3-22: *NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Mexico Starting on February 26, 2023*).

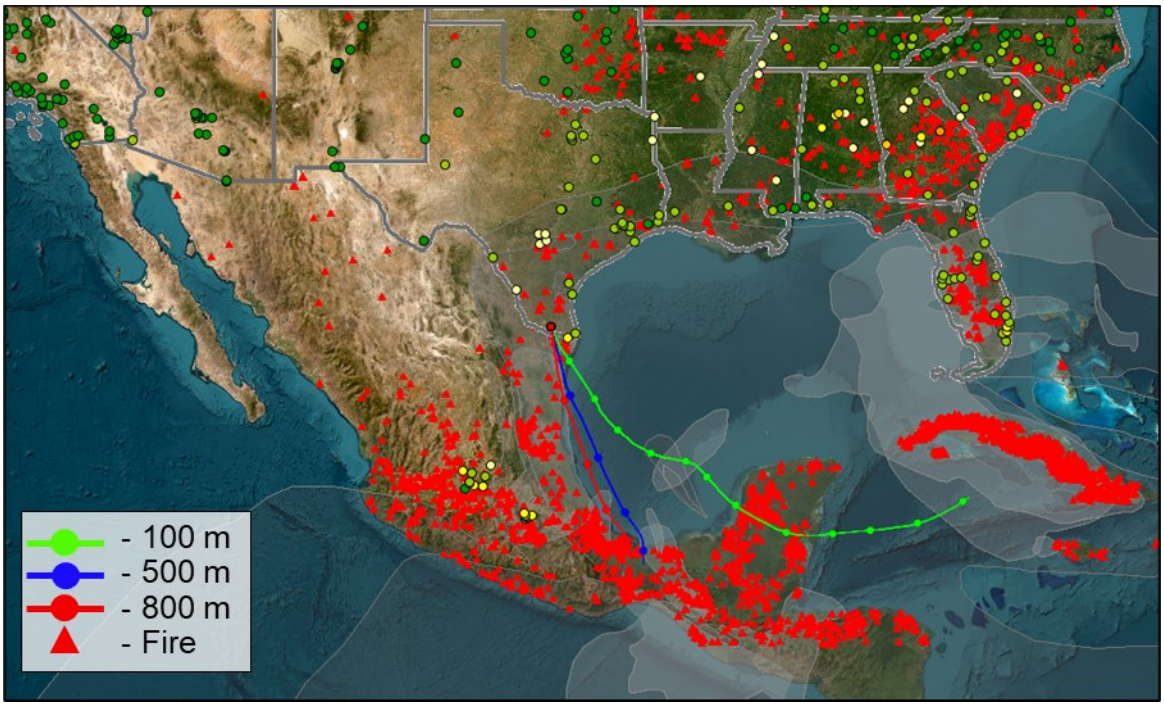

Figure 3-20: AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the East Freddy Gonzalez Drive Monitor on March 1, 2023

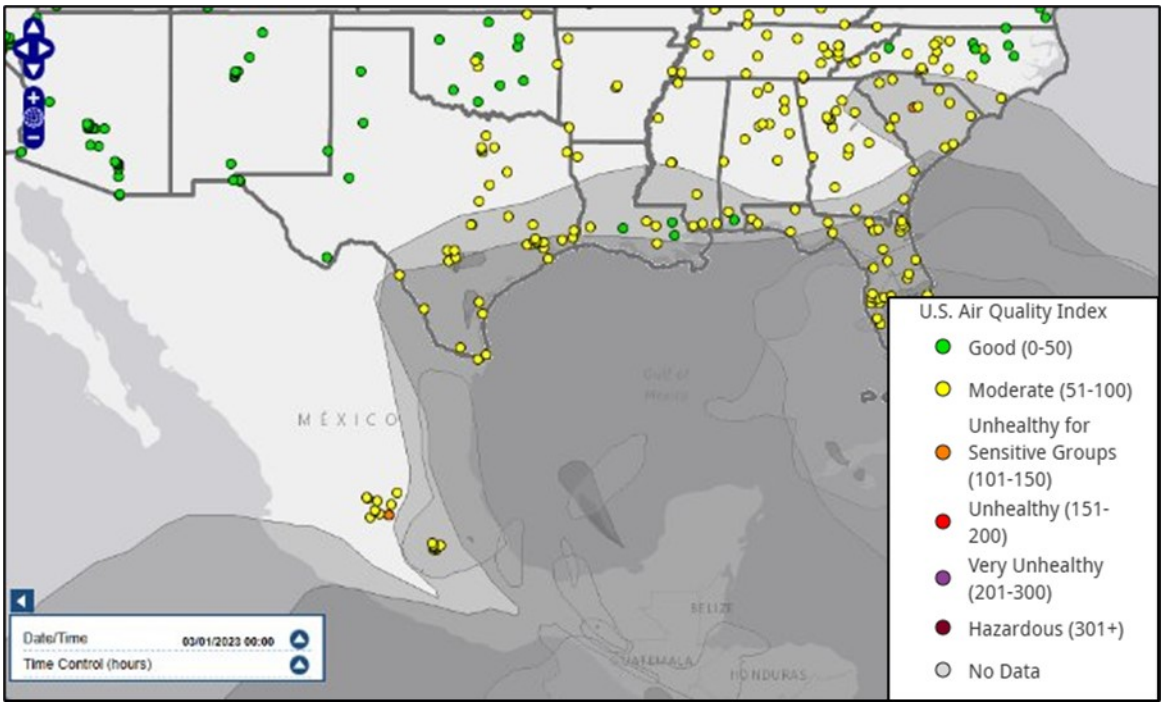

Figure 3-21: AirNow HMS Smoke Plume for March 1, 2023

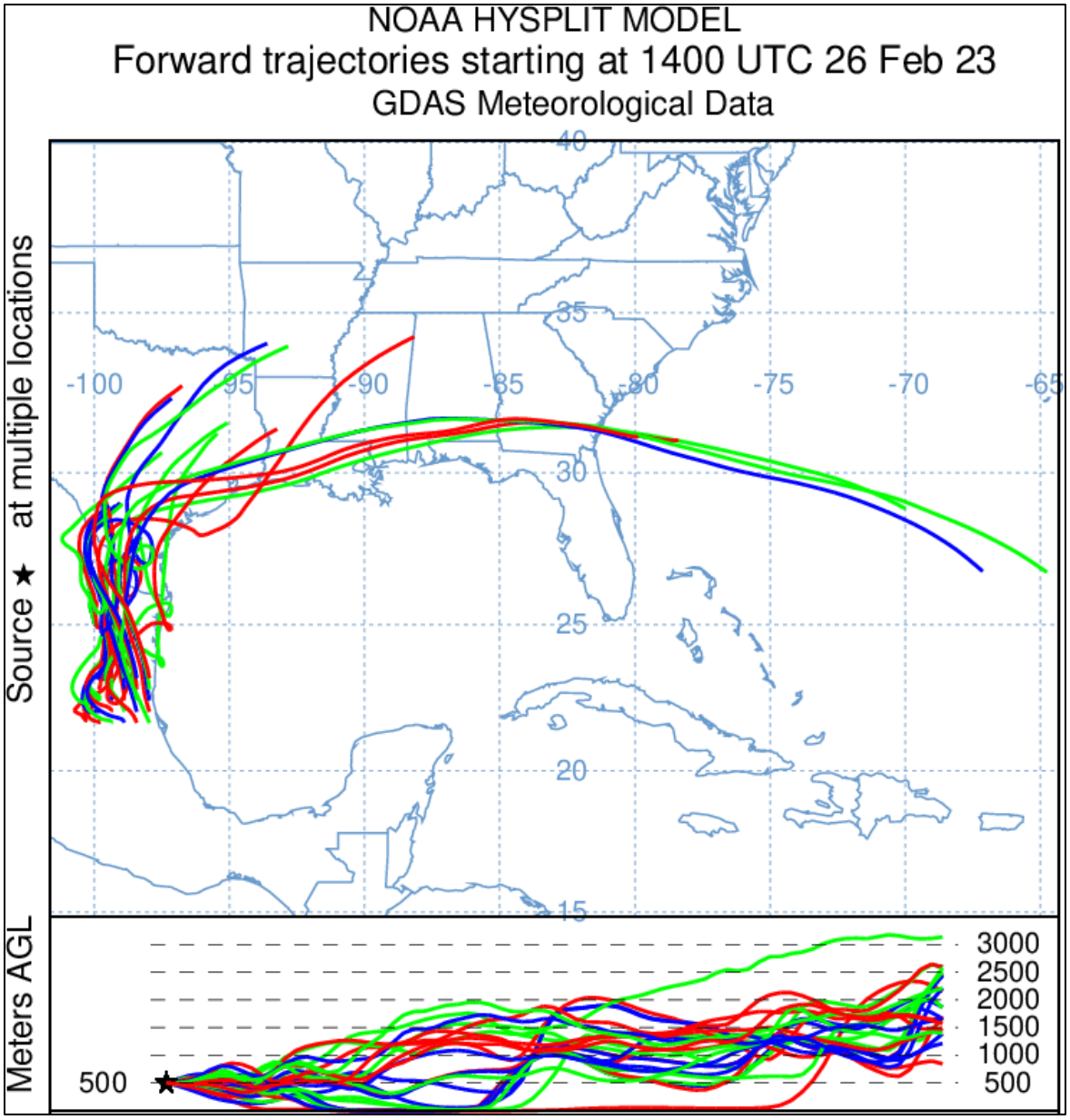

Figure 3-22: NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Mexico Starting on February 26, 2023

On March 2, 2023, the Edinburg East Freddy Gonzalez Drive monitor continued to experience the effects of smoke from fires in Mexico, and the TCEQ forecast mentions the persistence of this smoke in portions of South Texas (Figure C-3). The hourly $PM_{2.5}$ concentrations are compared to Tier 3 median values in Figure 3-23: *Hourly $PM_{2.5}$ Concentrations on March 2, 2023, Compared to Typical Concentrations at the Edinburg East Freddy Gonzalez Drive Monitor*. Back trajectories from this day show movement of air at the lower levels through areas of smoke along the Mexican coast. (Figure 3-24: *AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the East Freddy Gonzalez Drive Monitor on March 2, 2023*). This is corroborated by the smoke plume map showing light levels of smoke and Moderate AQI levels in South Texas (Figure 3-25: *AirNow HMS Smoke Plume for March 2, 2023*). Forward trajectories from fire areas in Central Mexico show the transport of air into South Texas (Figure 3-26: *NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Mexico Starting on February 27, 2023*).

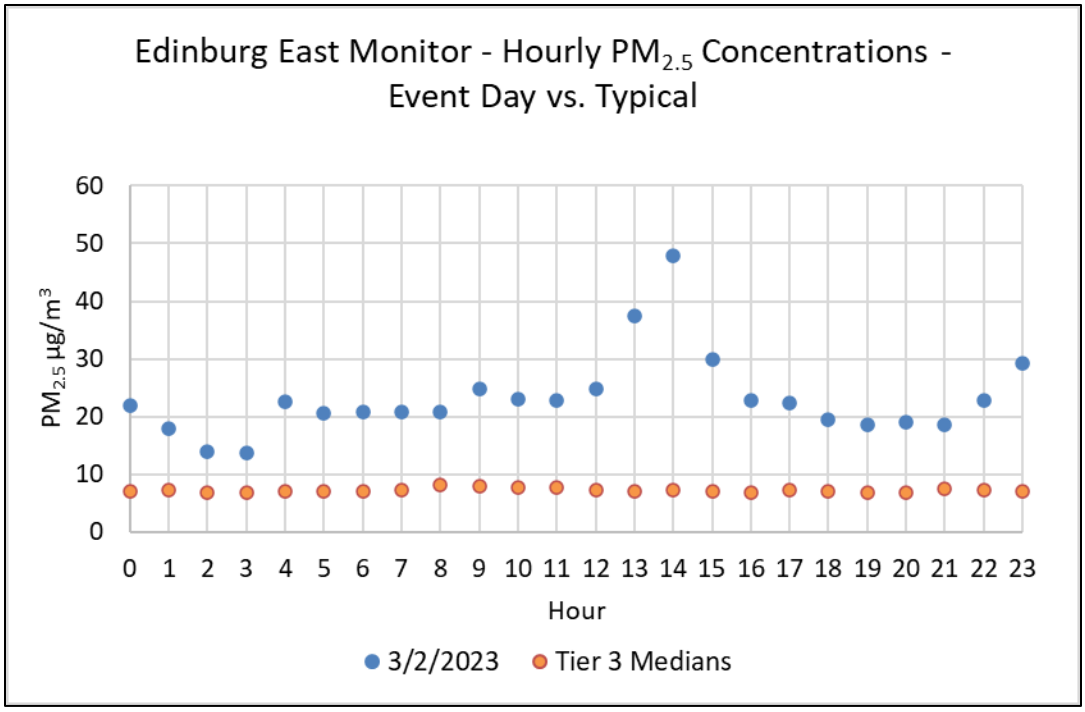

Figure 3-23: Hourly $PM_{2.5}$ Concentrations on March 2, 2023, Compared to Typical Concentrations at the Edinburg East Freddy Gonzalez Drive Monitor

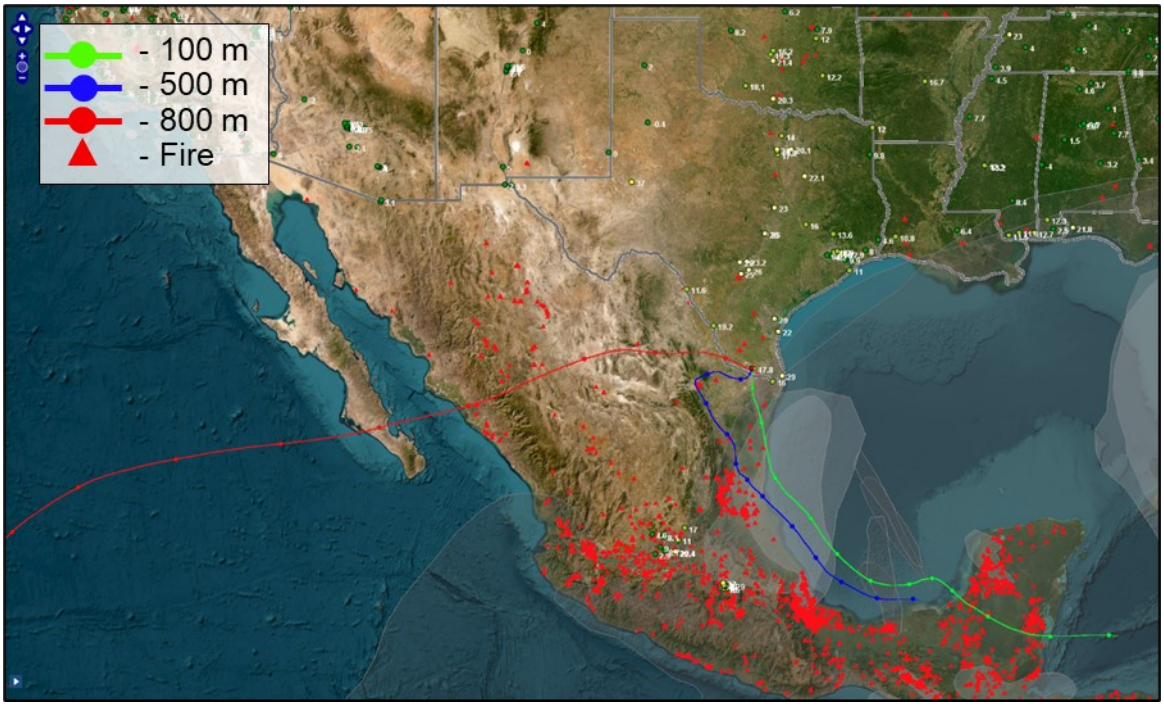

Figure 3-24: AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the East Freddy Gonzalez Drive Monitor on March 2, 2023

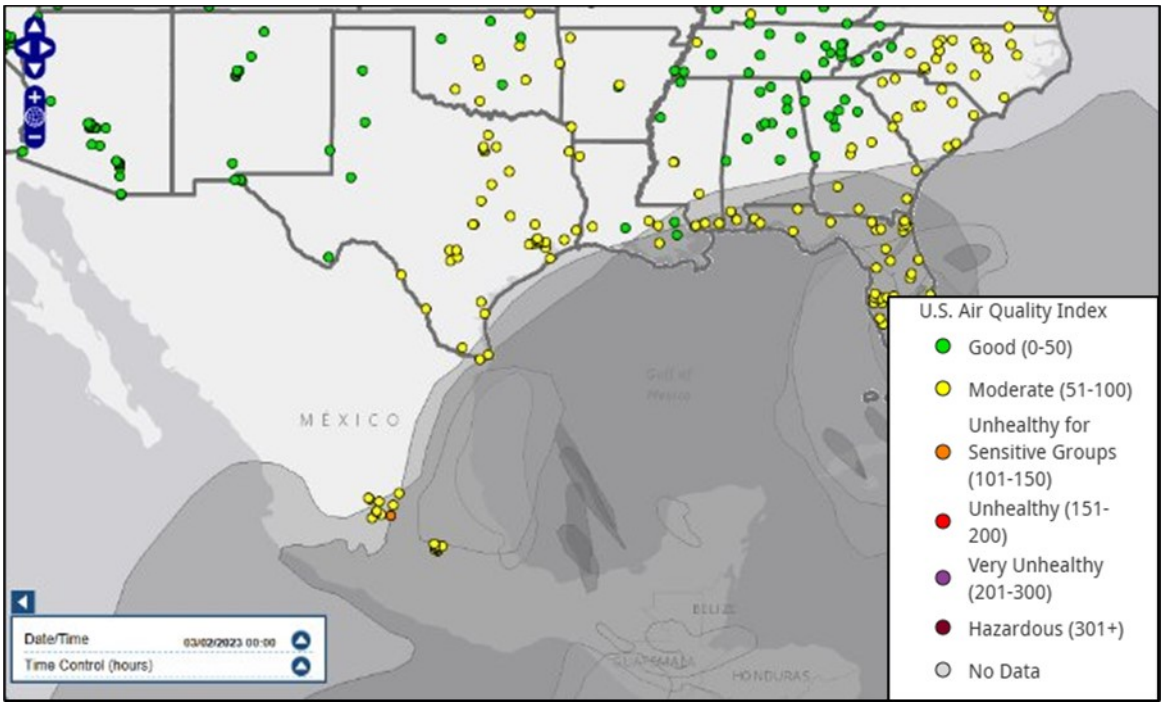

Figure 3-25: AirNow HMS Smoke Plume for March 2, 2023

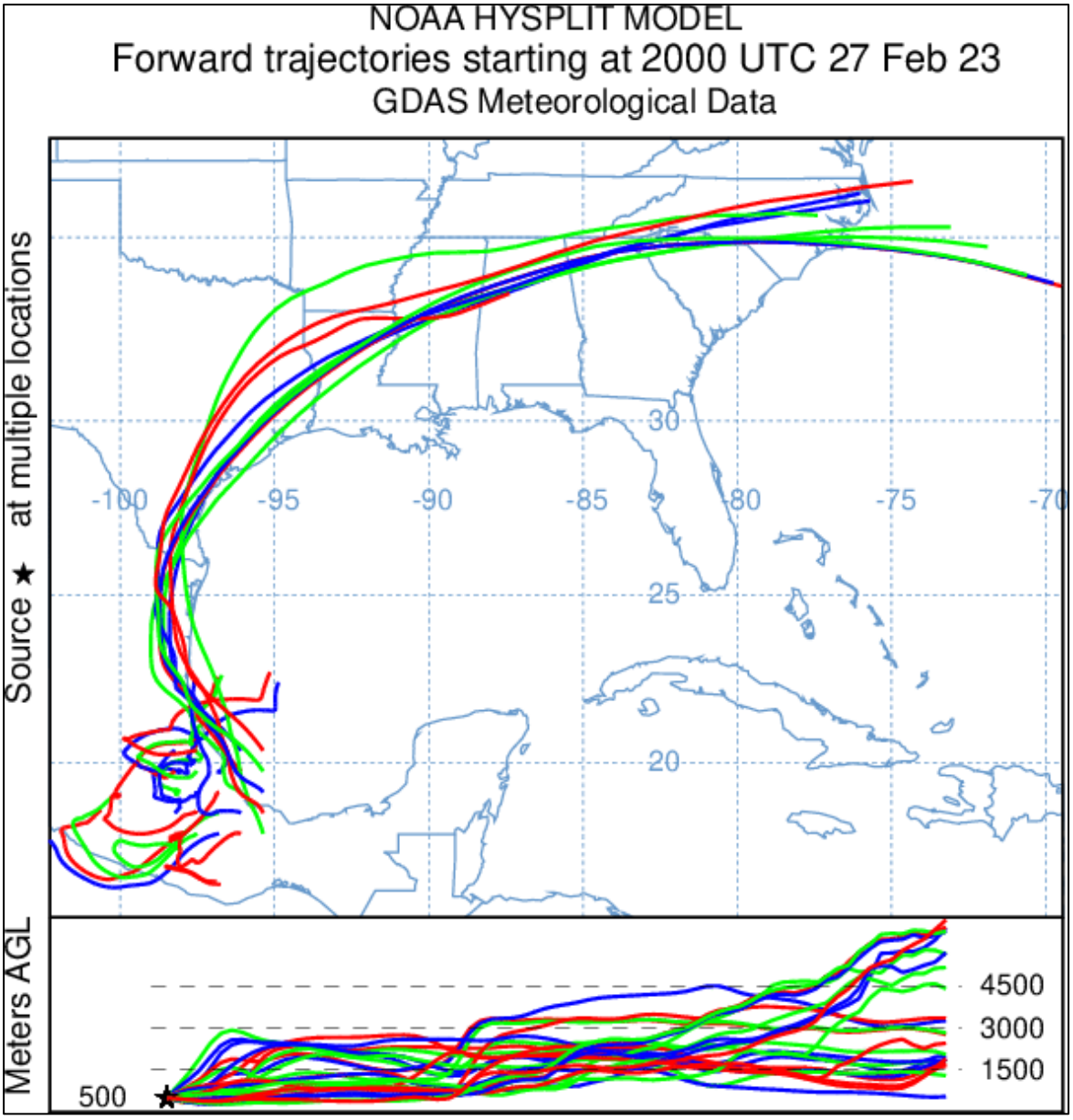

Figure 3-26: NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Mexico Starting on February 27, 2023

3.2.4 Group 4 – Evidence for the March 27, 2023, Fire (Mexico/Central America) $PM_{2.5}$ Event for the Edinburg East Freddy Gonzalez Drive Monitor

March 27, 2023, is classified as a Tier 2 day for the Edinburg East Freddy Gonzalez Drive monitor due to smoke from fires in Mexico. On this day, the 24-hr average concentration of $PM_{2.5}$ was 23.7 µg/m^3, and the hourly $PM_{2.5}$ concentrations are compared with Tier 3 typical values in Figure 3-27: *Hourly $PM_{2.5}$ Concentrations on March 27, 2023, Compared to Typical Concentrations at the Edinburg East Freddy Gonzalez Drive Monitor.*

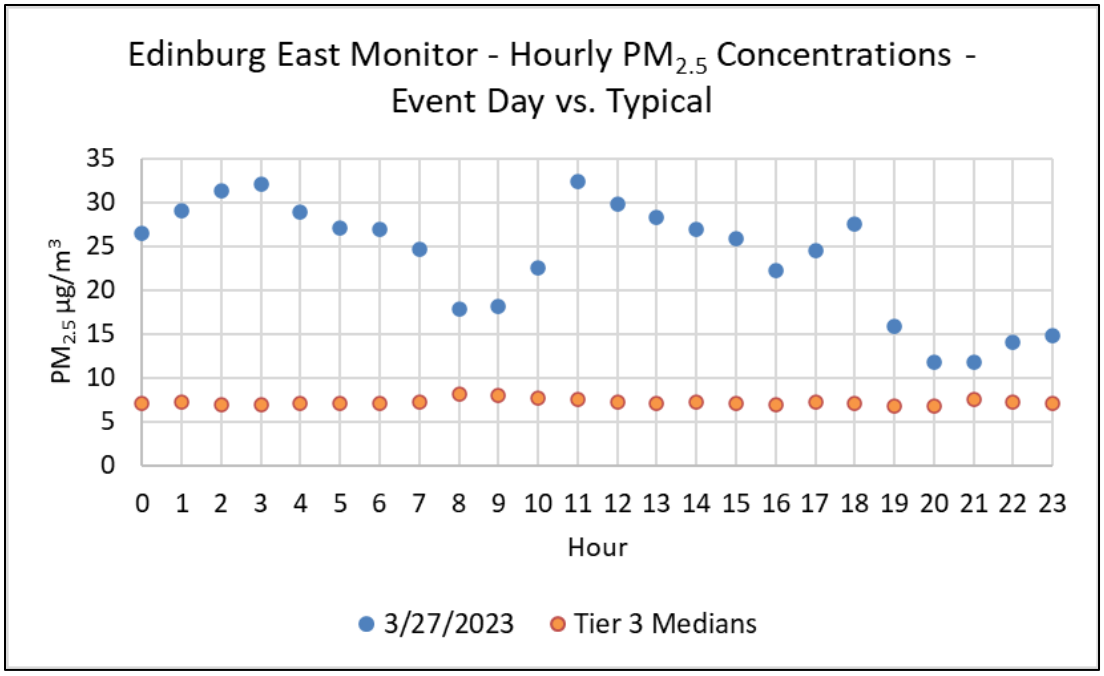

Figure 3-27: Hourly $PM_{2.5}$ Concentrations on March 27, 2023, Compared to Typical Concentrations at the Edinburg East Freddy Gonzalez Drive Monitor

Back trajectories from this day pass over areas of active fires in the Yucatan Peninsula (Figure 3-28: *AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the East Freddy Gonzalez Drive Monitor on March 27, 2023*). On the smoke plume map (Figure 3-29: *AirNow HMS Smoke Plume for March 27, 2023*), light to medium levels of smoke are seen along the Texas coastline, with Moderate AQI levels at coastal monitors in South Texas. The TCEQ forecast discussion mentions the Moderate AQI level in the Brownsville area due to agricultural burning in Mexico and Central America (Table C-4). Forward trajectories from fire areas in Mexico show the transport of air into South Texas, indicating that smoke may be affecting the measured concentrations at the monitor (Figure 3-30: *NOAA HYSPLIT 72 Hour Forward Trajectories Originating from Mexico Starting on March 24, 2023*).

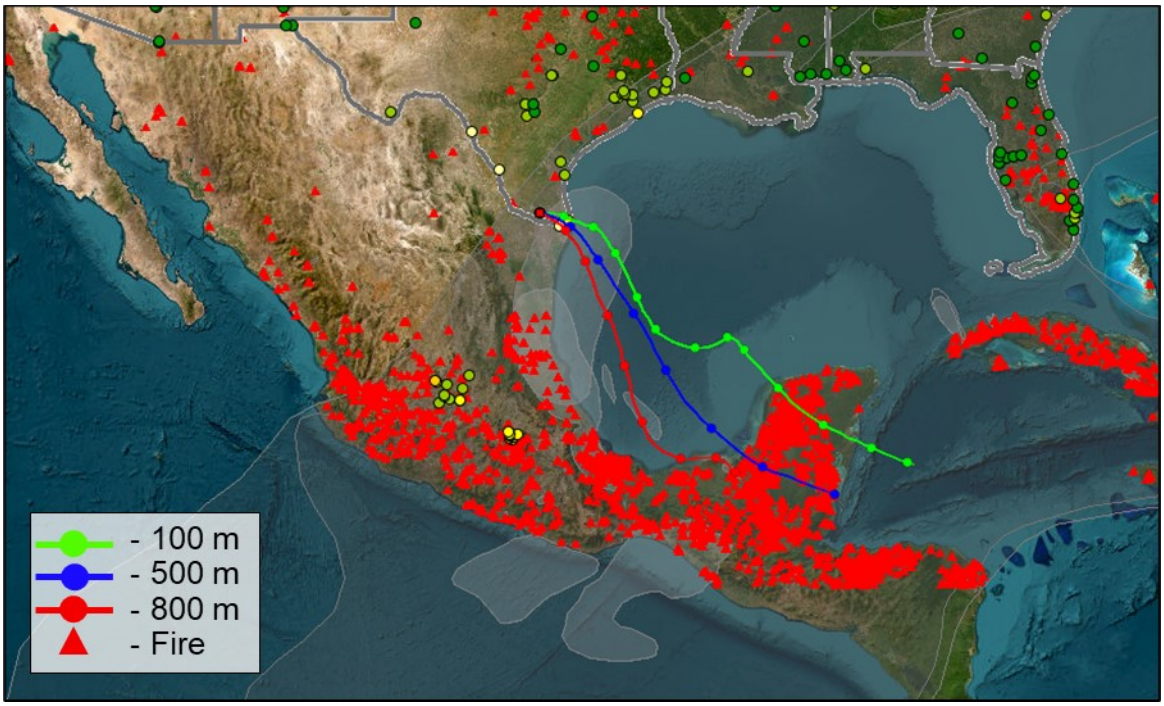

Figure 3-28: AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the East Freddy Gonzalez Drive Monitor on March 27, 2023

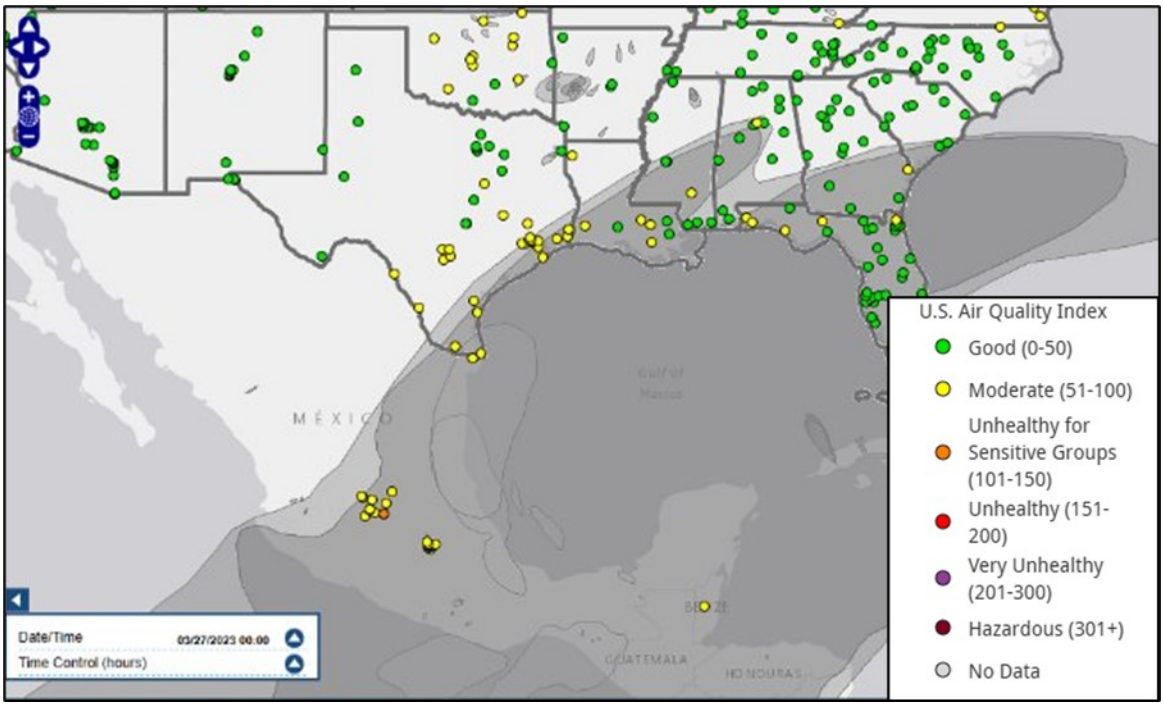

Figure 3-29: AirNow HMS Smoke Plume for March 27, 2023

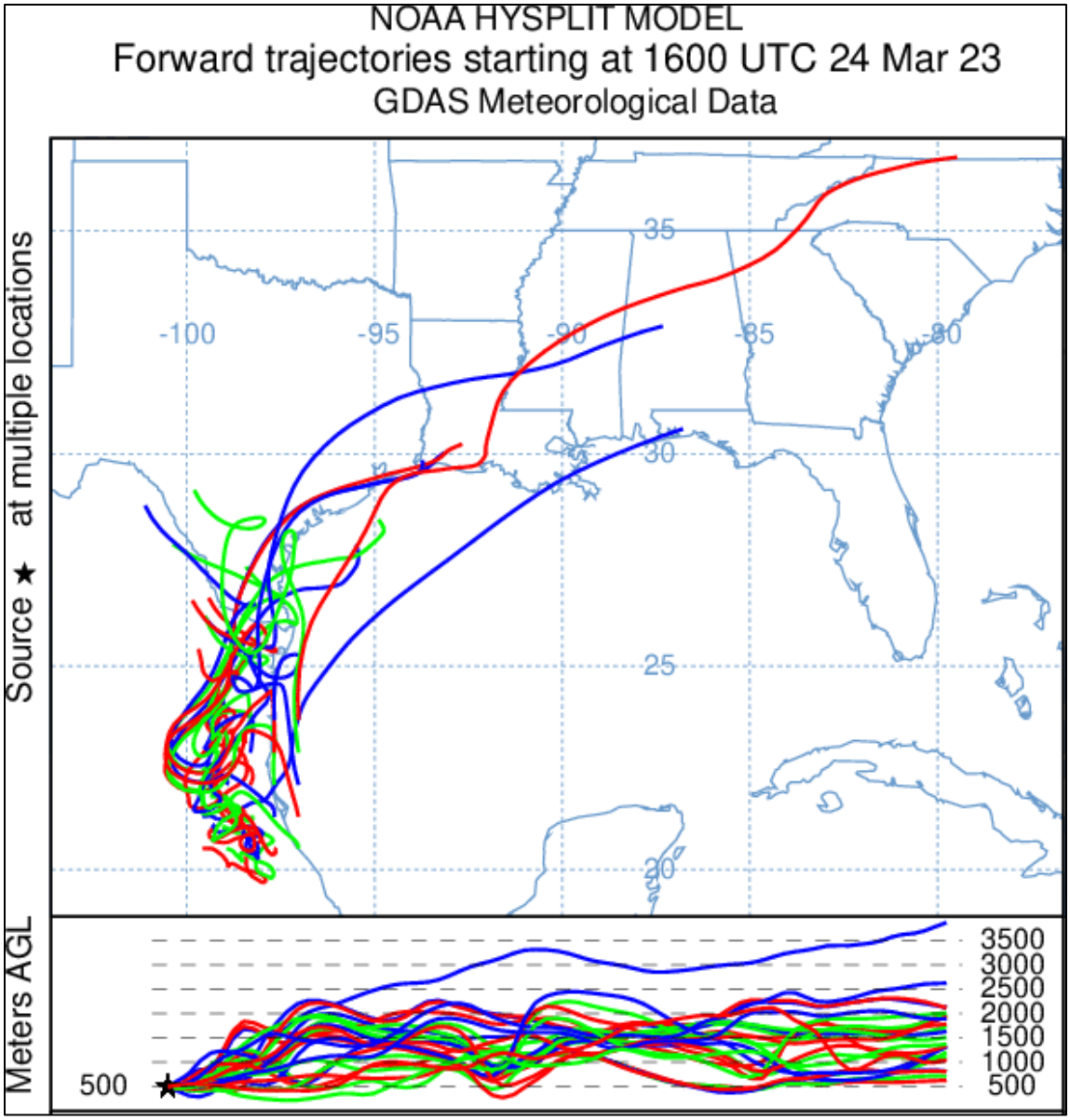

Figure 3-30: NOAA HYSPLIT 72 Hour Forward Trajectories Originating from Mexico Starting on March 24, 2023

3.2.5 Group 5 – Evidence for the April 4, 2023, Fire (Mexico/Central America) $PM_{2.5}$ Event for the Edinburg East Freddy Gonzalez Drive Monitor

April 4, 2023, is identified as a Tier 2 day due to smoke from fires in Mexico impacting the Edinburg East Freddy Gonzalez Drive monitor. High concentrations on this day were measured after 6 a.m. local time, and hourly $PM_{2.5}$ concentrations are compared to Tier 3 median values in Figure 3-31: *Hourly $PM_{2.5}$ Concentrations on April 4, 2023, Compared to Typical Concentrations at the Edinburg East Freddy Gonzalez Drive Monitor*. Back trajectories from this monitor show transport of air from fire areas in Mexico, and through areas of light to medium smoke (Figure 3-32: *AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the East Freddy Gonzalez Drive Monitor on April 4, 2023*). The TCEQ forecast discussion describes light to moderate amounts of residual smoke from agricultural and industrial burning activity in Mexico and Central America (Table C-5). Most of the state experienced moderate air quality

levels, with the smoke mainly affecting South Texas (Figure 3-33: *AirNow HMS Smoke Plume for April 4, 2023*). Forward trajectories starting on April 1 show the movement of air from Mexico to the eastern half of Texas (Figure 3-34: *NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Mexico Starting on April 1, 2023*).

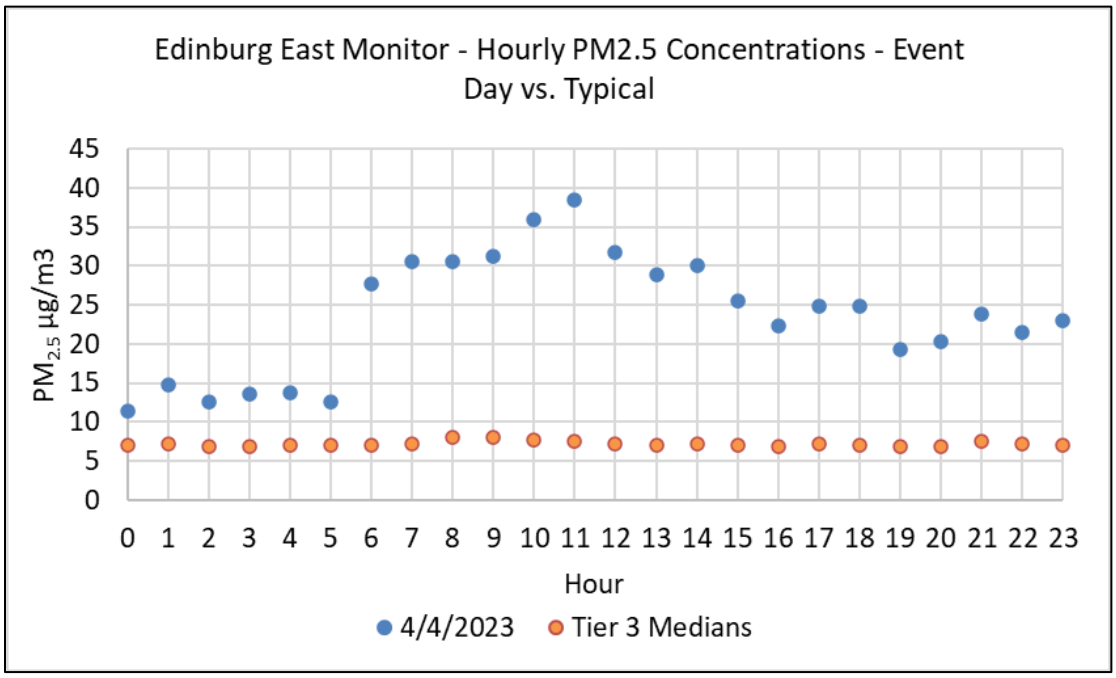

Figure 3-31: Hourly $PM_{2.5}$ Concentrations on April 4, 2023, Compared to Typical Concentrations at the Edinburg East Freddy Gonzalez Drive Monitor

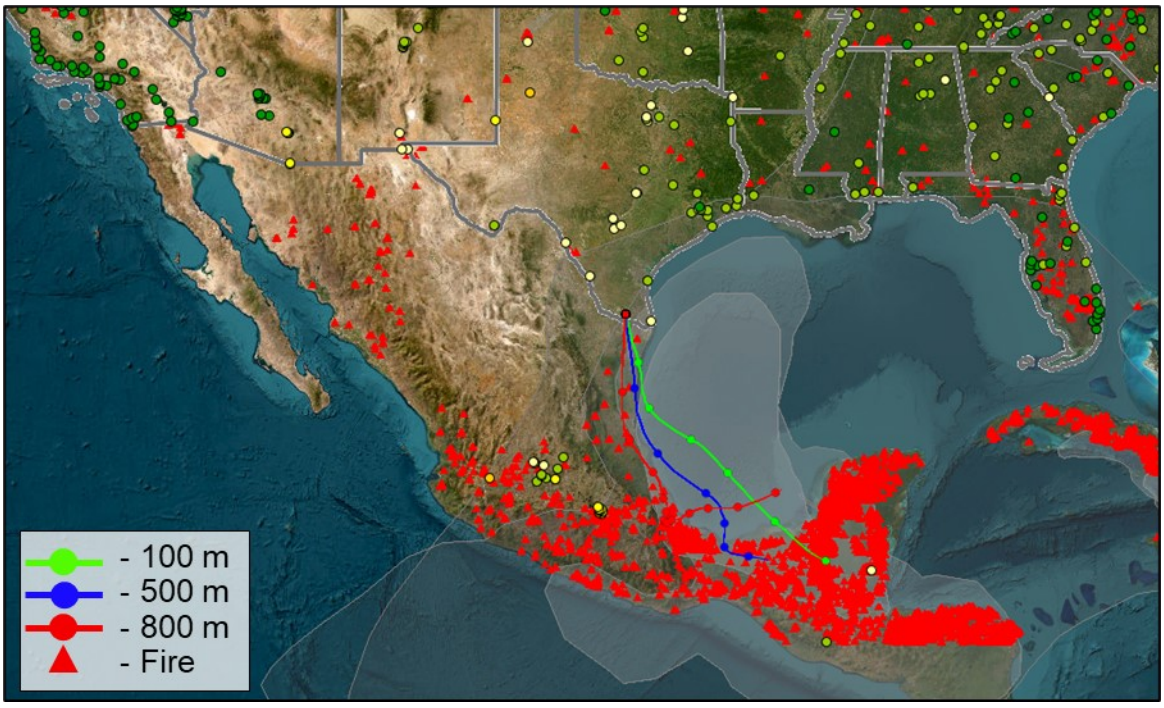

Figure 3-32: AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the East Freddy Gonzalez Drive Monitor on April 4, 2023

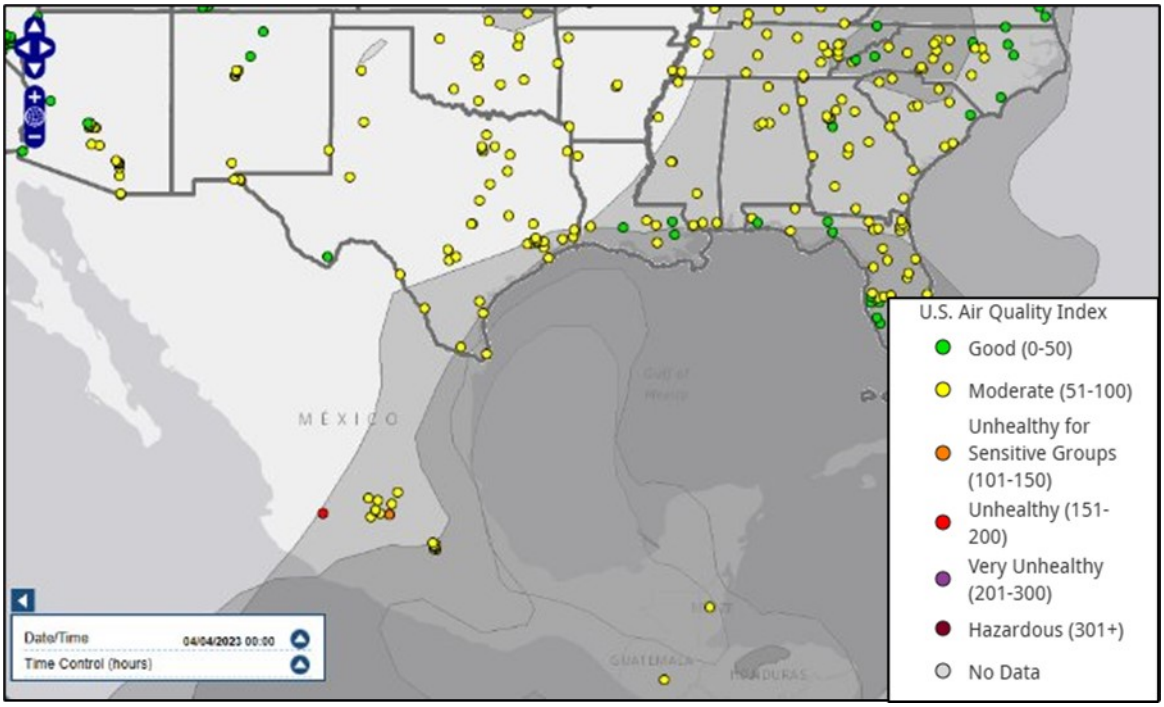

Figure 3-33: AirNow HMS Smoke Plume for April 4, 2023

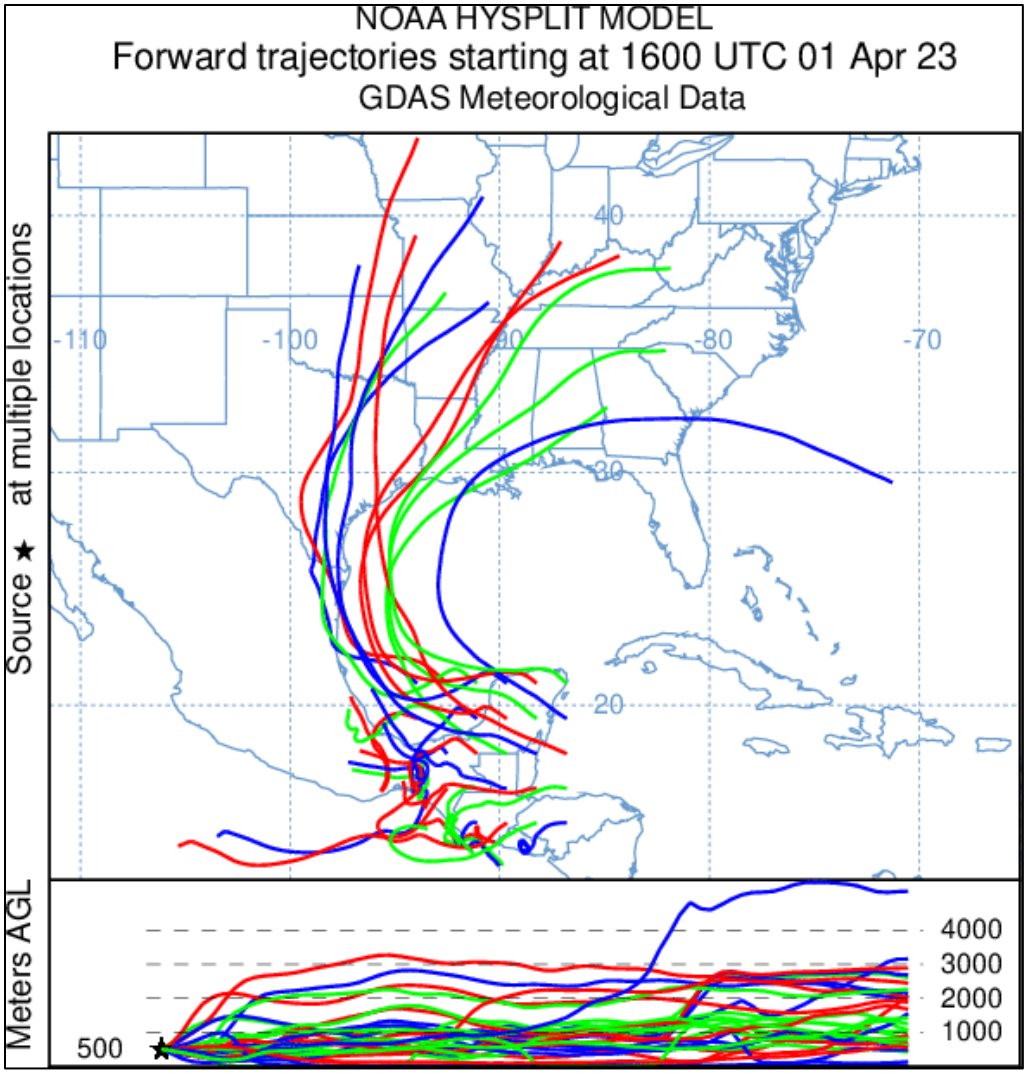

Figure 3-34: NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Mexico Starting on April 1, 2023

3.2.6 Group 6 – Evidence for the April 15, 2023, Fire (Mexico/Central America) $PM_{2.5}$ Event for the Edinburg East Freddy Gonzalez Drive Monitor

Transported smoke from fires in Mexico affected the Edinburg East Freddy Gonzalez Drive monitor on April 15, 2023. This day was identified as a Tier 2 day, and the high hourly concentrations on this day are compared to typical median values in Figure 3-35: *Hourly $PM_{2.5}$ Concentrations on April 15, 2023, Compared to Typical Concentrations at the Edinburg East Freddy Gonzalez Drive Monitor.*

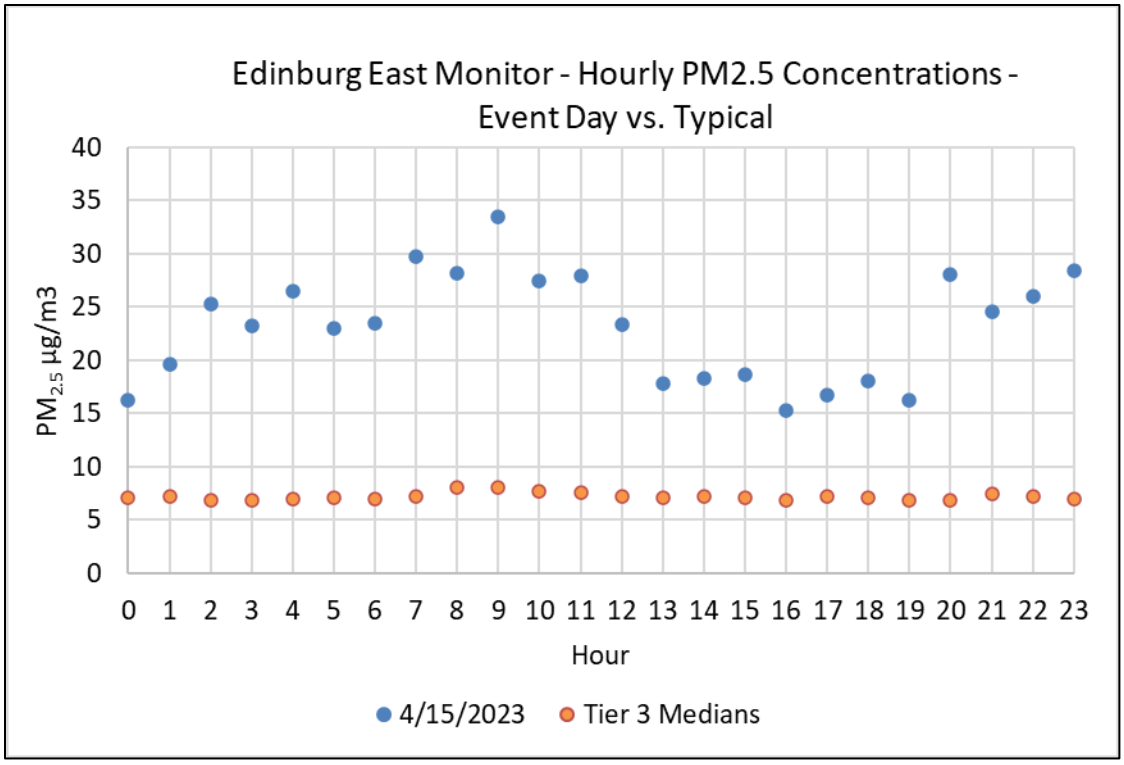

Figure 3-35: Hourly $PM_{2.5}$ Concentrations on April 15, 2023, Compared to Typical Concentrations at the Edinburg East Freddy Gonzalez Drive Monitor

Air at lower levels was transported from the Bay of Campeche near fire areas along the Mexican coast (Figure 3-36: *AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the East Freddy Gonzalez Drive Monitor on April 15, 2023*). The TCEQ forecast mentions patchy smoke from agricultural burning expanding north over Deep South Texas (Table C-6), and the elevated smoke levels lead to Moderate AQI levels in the monitoring area (Figure 3-37: *AirNow HMS Smoke Plume for April 15, 2023*). Forward trajectories from Central Mexico a few days before the event day show the transport of air from fire areas into South Texas (Figure 3-38: *NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Mexico Starting on April 12, 2023*).

Figure 3-36: AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the East Freddy Gonzalez Drive Monitor on April 15, 2023

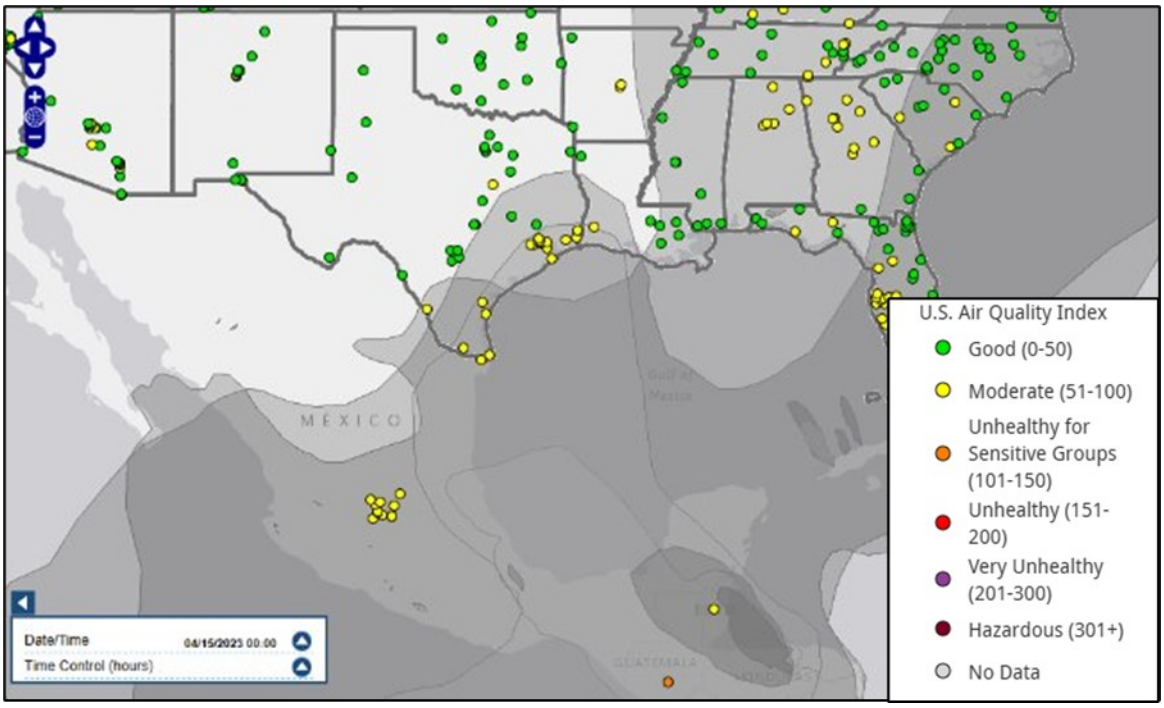

Figure 3-37: AirNow HMS Smoke Plume for April 15, 2023

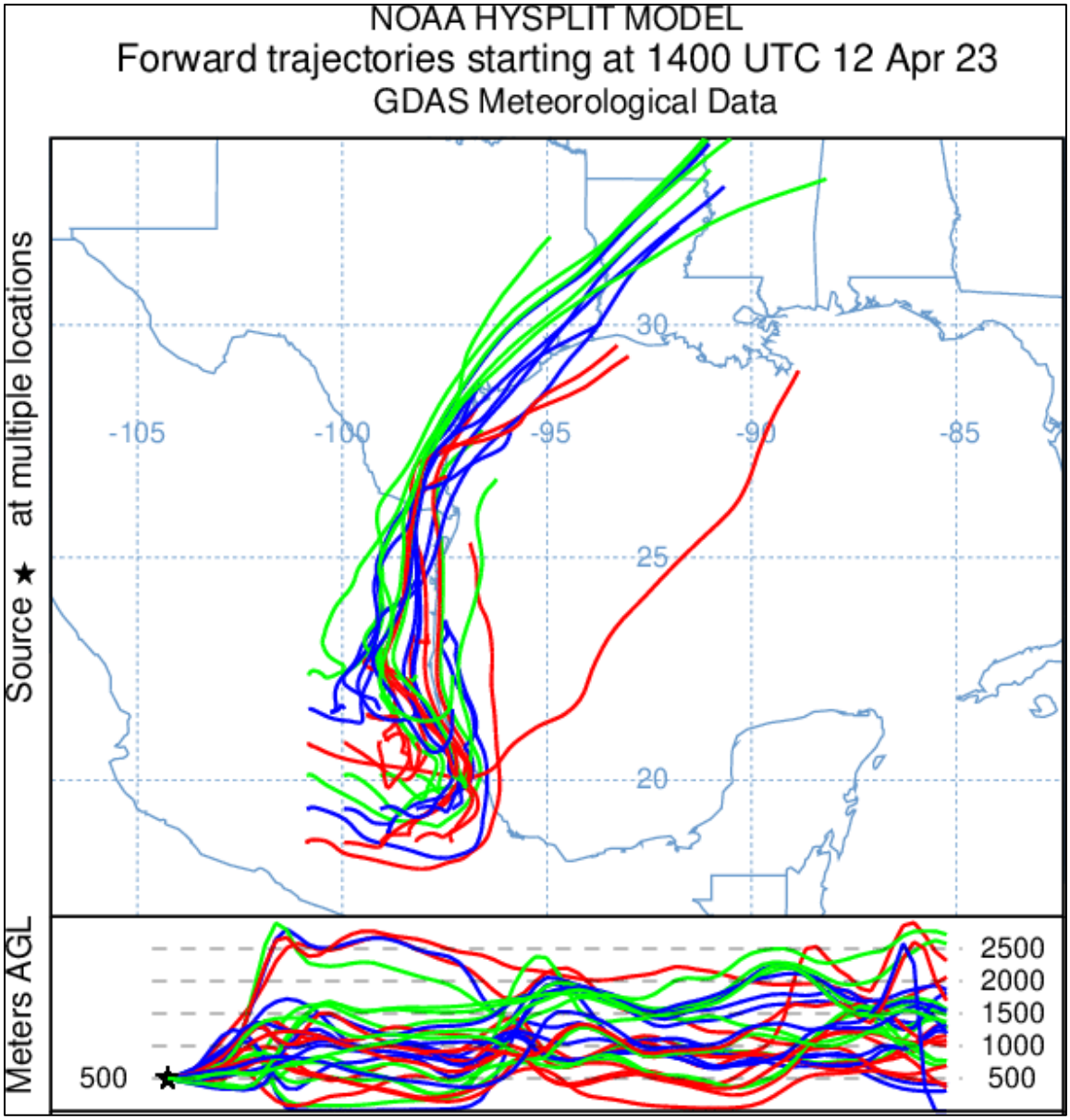

Figure 3-38: NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Mexico Starting on April 12, 2023

3.2.7 Group 7 – Evidence for the May 5 and May 6, 2023, Fire (Mexico/Central America) $PM_{2.5}$ Event for the Edinburg East Freddy Gonzalez Drive, World Trade Bridge, and Von Ormy Highway 16 Monitors

On May 5, 2023, the World Trade Bridge and Edinburg East Freddy Gonzalez Drive monitors measured 24-hr concentrations of 31.4 µg/m^3 (Tier 1 day) and 28.2 µg/m^3 (Tier 2 day) respectively. On May 6, 2023, the Von Ormy Highway 16, Edinburg East Freddy Gonzalez Drive, and the World Trade Bridge monitors measured 24-hr concentrations of 28.1 µg/m^3 (Tier 2), 30.5 µg/m^3 (Tier 1), and 39.8 µg/m^3 (Tier 1) respectively. These elevated concentrations across both days were due to smoke from fires in Mexico.

On May 5, hourly $PM_{2.5}$ concentrations are compared against typical values in Figure 3-39: *Hourly $PM_{2.5}$ Concentrations on May 5, 2023, Compared to Typical Concentrations at the World*

Trade Bridge Monitor and Figure 3-40: *Hourly $PM_{2.5}$ Concentrations on May 5, 2023, Compared to Typical Concentrations at the Edinburg East Freddy Gonzalez Drive Monitor*. Back trajectories from both monitors show transport of air from fire regions in Mexico (Figure 3-41: *AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the East Freddy Gonzalez Drive Monitor on May 5, 2023* and Figure 3-42: *AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the World Trade Bridge Monitor on May 5, 2023*). The World Trade Bridge and Edinburg East Freddy Gonzalez Drive monitors had Moderate AQI levels on this day, with layers of smoke denoted in the same area (Figure 3-43: *AirNow HMS Smoke Plume for May 5, 2023*). The TCEQ forecast discussion (Table C-7) mentions a large area of thin to moderate smoke from ongoing fire activity in Mexico and Central America. Air quality impacts were noted in a news release from the City of Corpus Christi due to fire activities in Mexico and Central America (Figure C-4). Forward trajectories from the Yucatan peninsula starting a few days before the event show the movement of air from fire areas to South Texas, affecting the two monitors on May 5 (Figure 3-44: *NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Mexico Starting on May 2, 2023*).

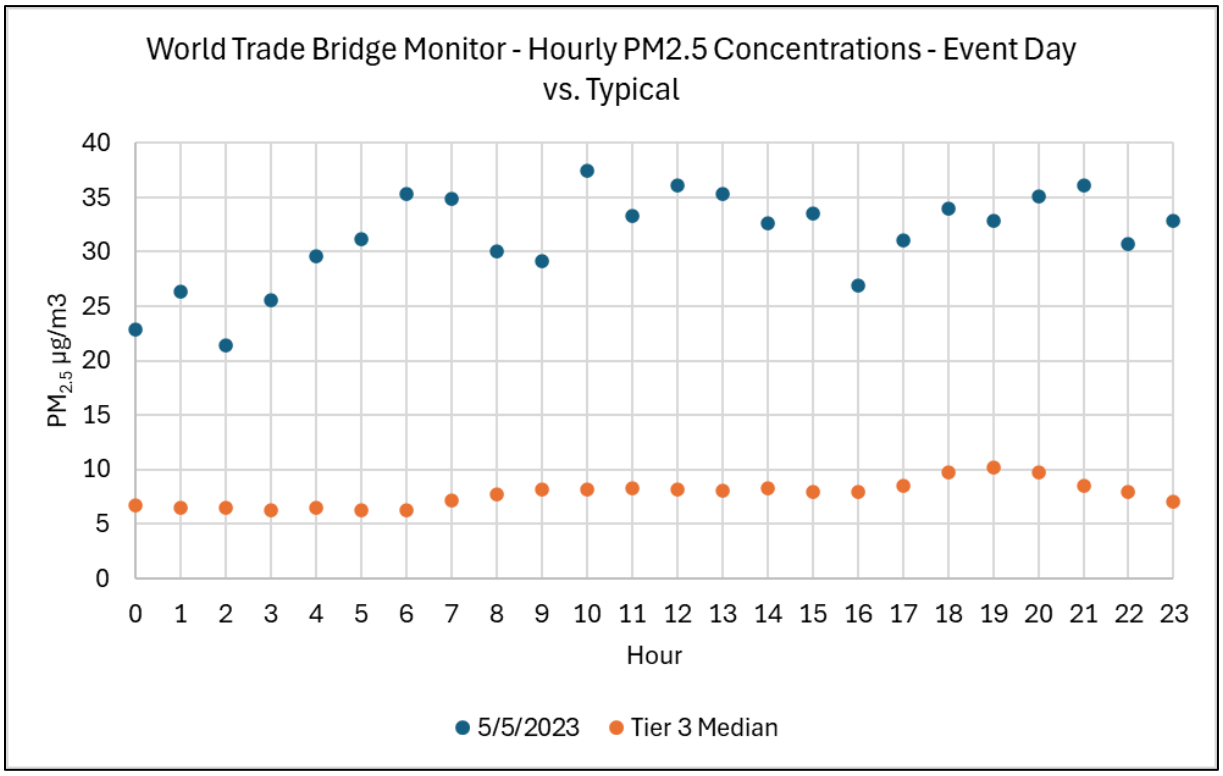

Figure 3-39: Hourly $PM_{2.5}$ Concentrations on May 5, 2023, Compared to Typical Concentrations at the World Trade Bridge Monitor

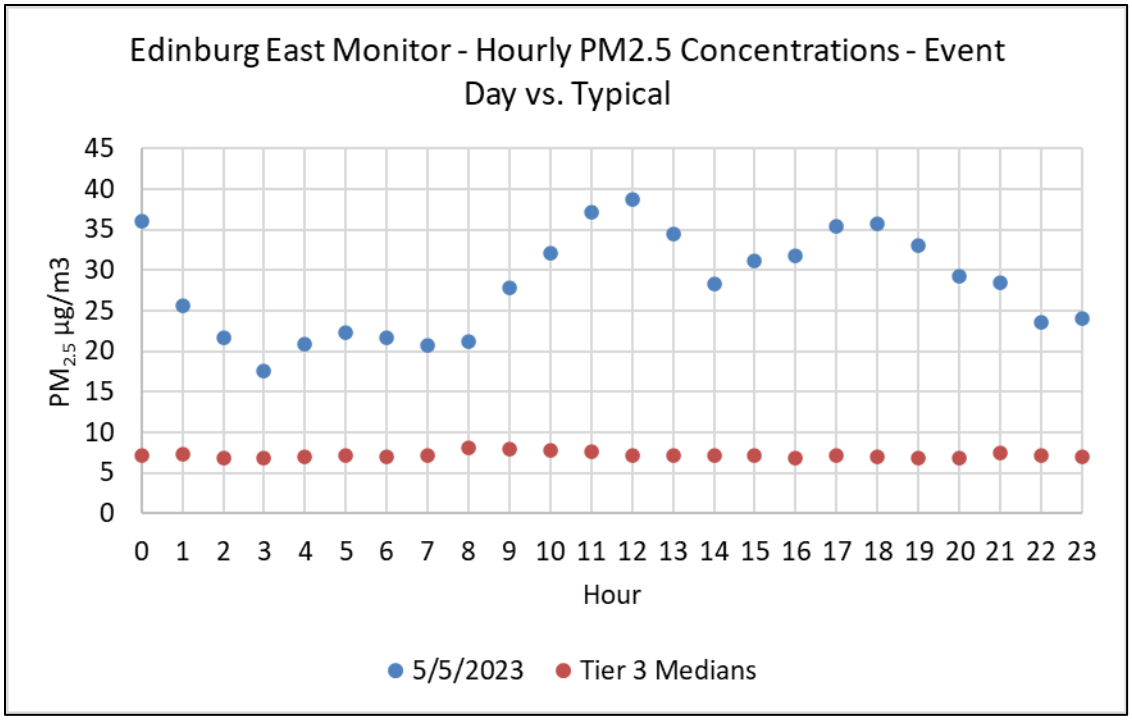

Figure 3-40: Hourly $PM_{2.5}$ Concentrations on May 5, 2023, Compared to Typical Concentrations at the Edinburg East Freddy Gonzalez Drive Monitor

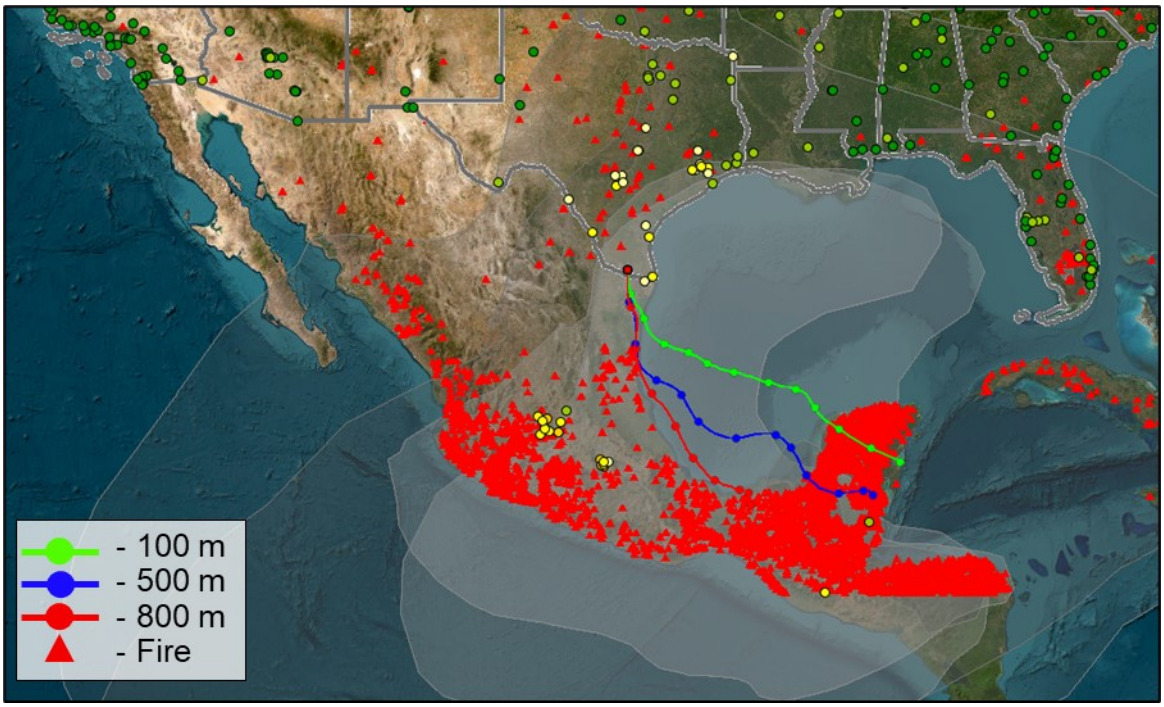

Figure 3-41: AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the East Freddy Gonzalez Drive Monitor on May 5, 2023

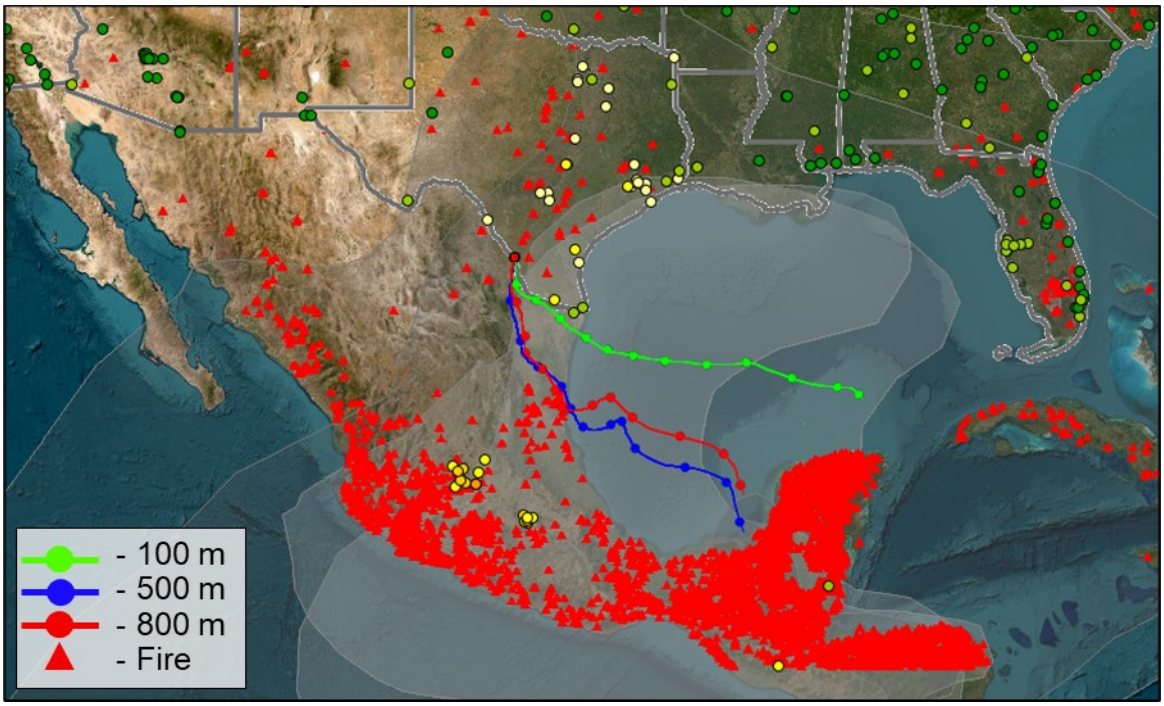

Figure 3-42: AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the World Trade Bridge Monitor on May 5, 2023

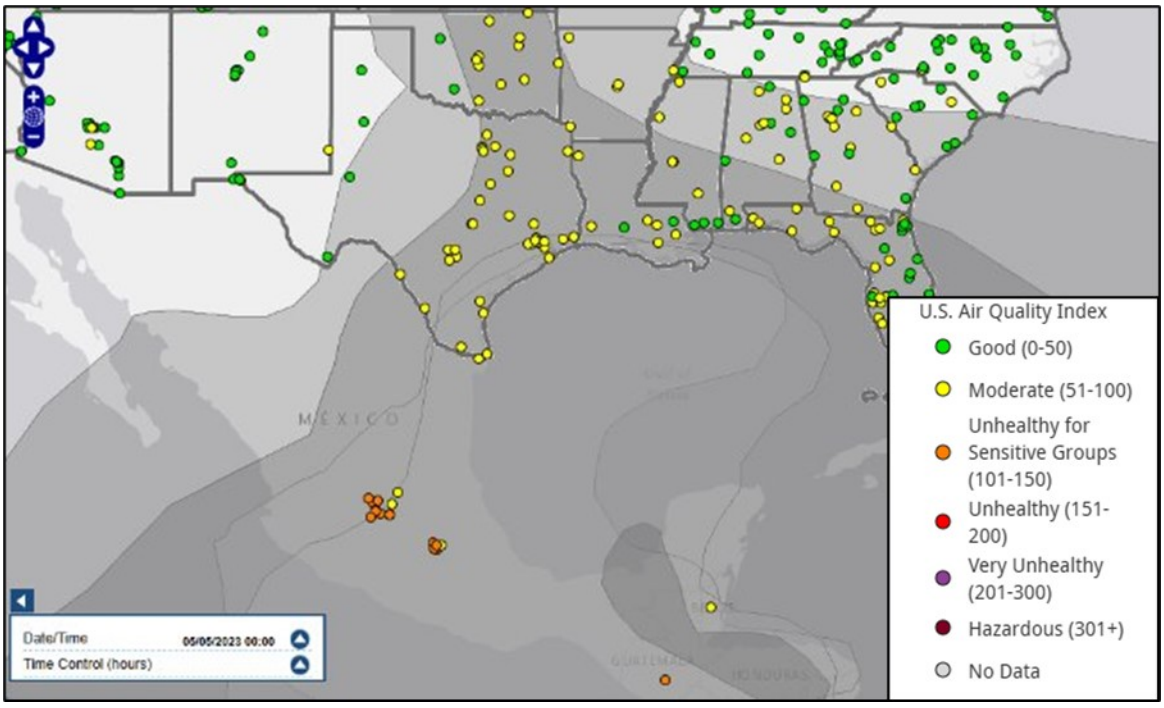

Figure 3-43: AirNow HMS Smoke Plume for May 5, 2023

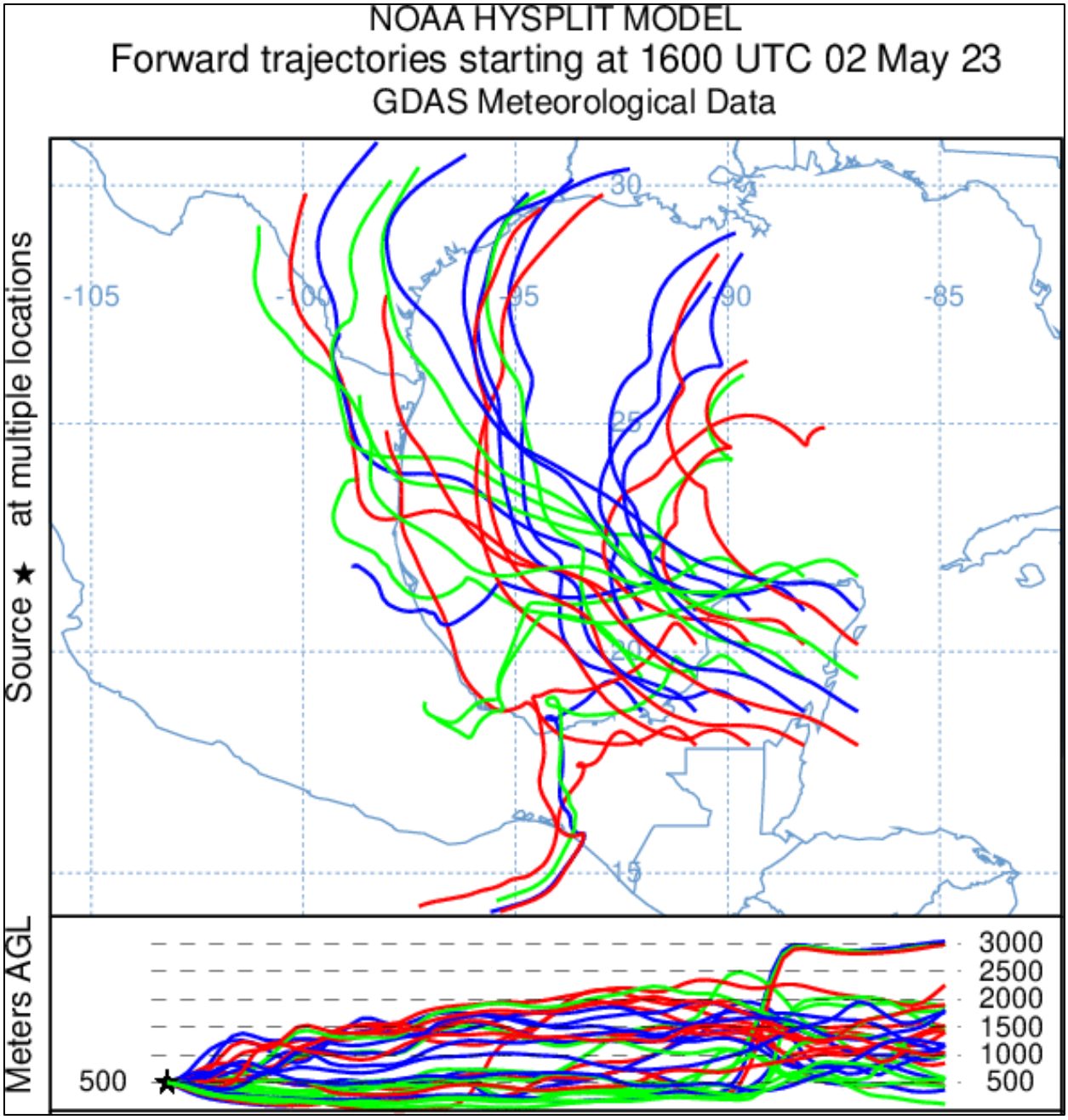

Figure 3-44: NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Mexico Starting on May 2, 2023

On May 6, hourly $PM_{2.5}$ concentrations are compared against typical hourly values for each of the three monitors in Figure 3-45: *Hourly $PM_{2.5}$ Concentrations on May 6, 2023, Compared to Typical Concentrations at the Edinburg East Freddy Gonzalez Drive Monitor*, Figure 3-46: *Hourly $PM_{2.5}$ Concentrations on May 6, 2023, compared to typical concentrations Compared to Typical Concentrations at the Von Ormy Highway 16 Monitor*, and Figure 3-47: *Hourly $PM_{2.5}$ Concentrations on May 6, 2023, Compared to Typical Concentrations at the World Trade Bridge Monitor.*

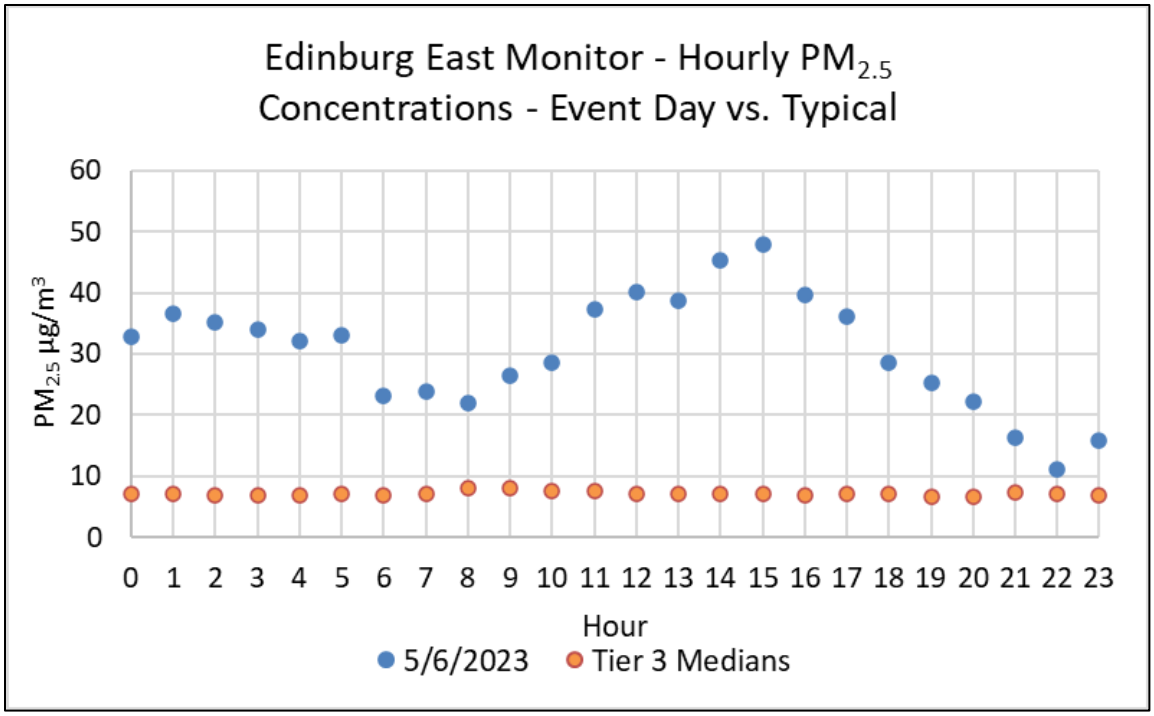

Figure 3-45: Hourly $PM_{2.5}$ Concentrations on May 6, 2023, Compared to Typical Concentrations at the Edinburg East Freddy Gonzalez Drive Monitor

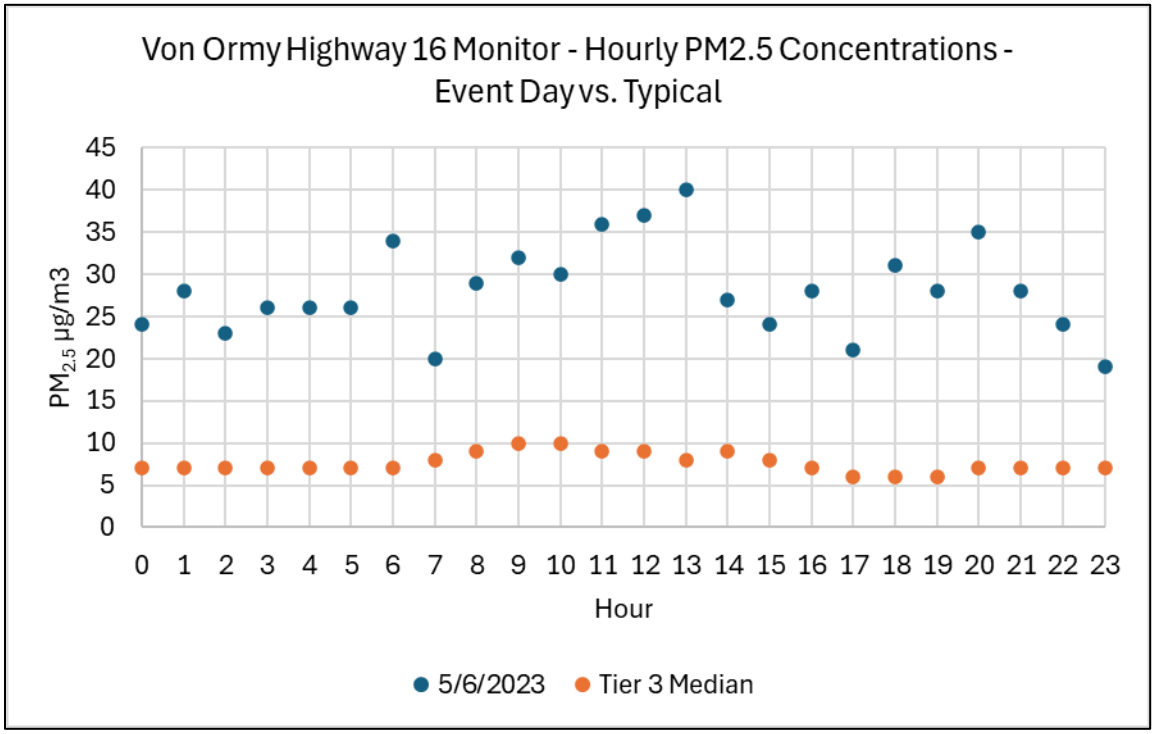

Figure 3-46: Hourly $PM_{2.5}$ Concentrations on May 6, 2023, compared to typical concentrations Compared to Typical Concentrations at the Von Ormy Highway 16 Monitor

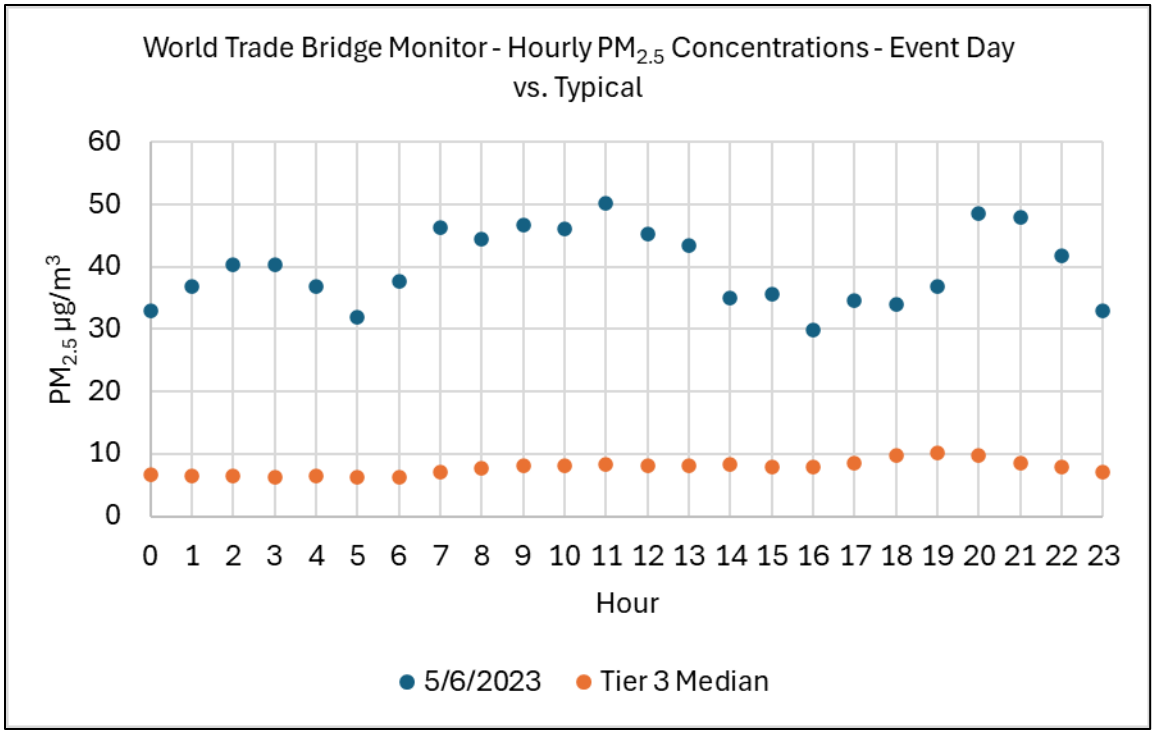

Figure 3-47: Hourly $PM_{2.5}$ Concentrations on May 6, 2023, Compared to Typical Concentrations at the World Trade Bridge Monitor

Back trajectories from all three monitors on May 6 show movement of air over the Bay of Campeche and along the Mexican coastline (Figure 3-48: *AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the East Freddy Gonzalez Drive Monitor on May 6, 2023*, Figure 3-49: *AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the Von Ormy Highway 16 Monitor on May 6, 2023*, and Figure 3-50: *AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the World Trade Bridge Monitor on May 6, 2023*). Moderate to Unhealthy AQI levels of $PM_{2.5}$ are denoted on the fire and smoke map in South and Central Texas due to the light and medium levels of smoke (Figure 3-51: *AirNow HMS Smoke Plume for May 6, 2023*). The TCEQ forecast discussion (Table C-7) mentions residual smoke from ongoing fire activity in Mexico and Central America. A media report from San Antonio discussed poor air quality in South Texas due to burning in Mexico (Figure C-5). Forward trajectories from the Yucatan peninsula from a few days before the event day show the transport of air from fires in Mexico up through South and Central Texas (Figure 3-52: *NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Mexico Starting on May 3, 2023*).

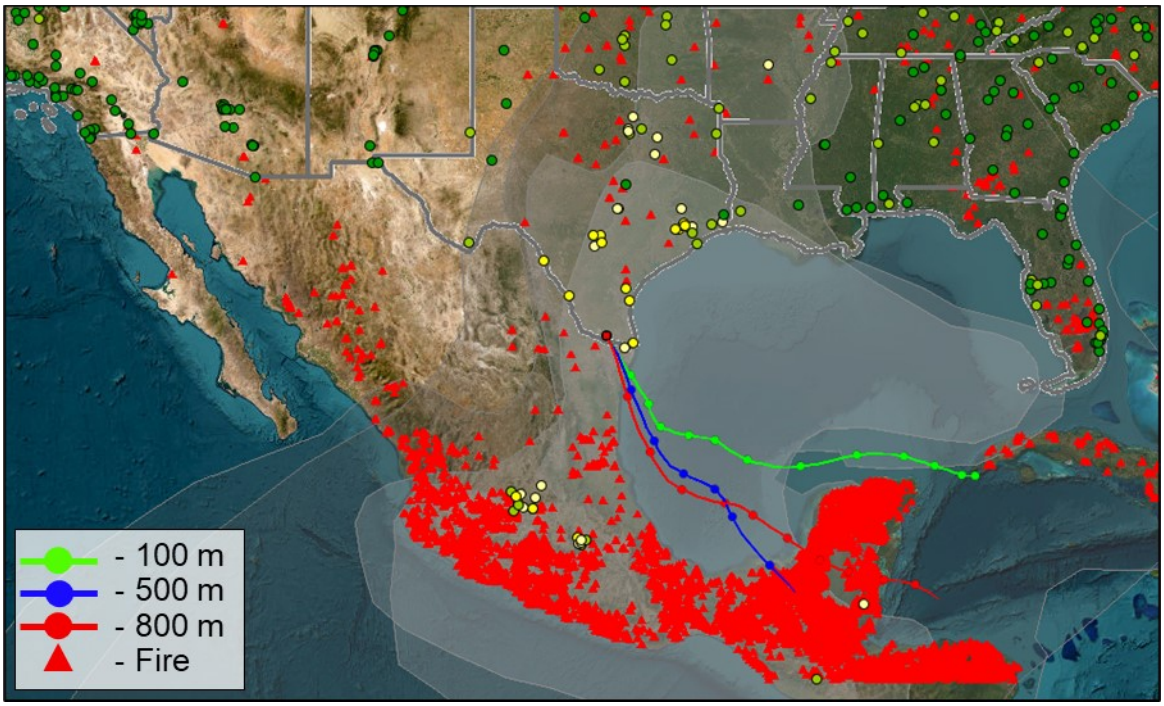

Figure 3-48: AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the East Freddy Gonzalez Drive Monitor on May 6, 2023

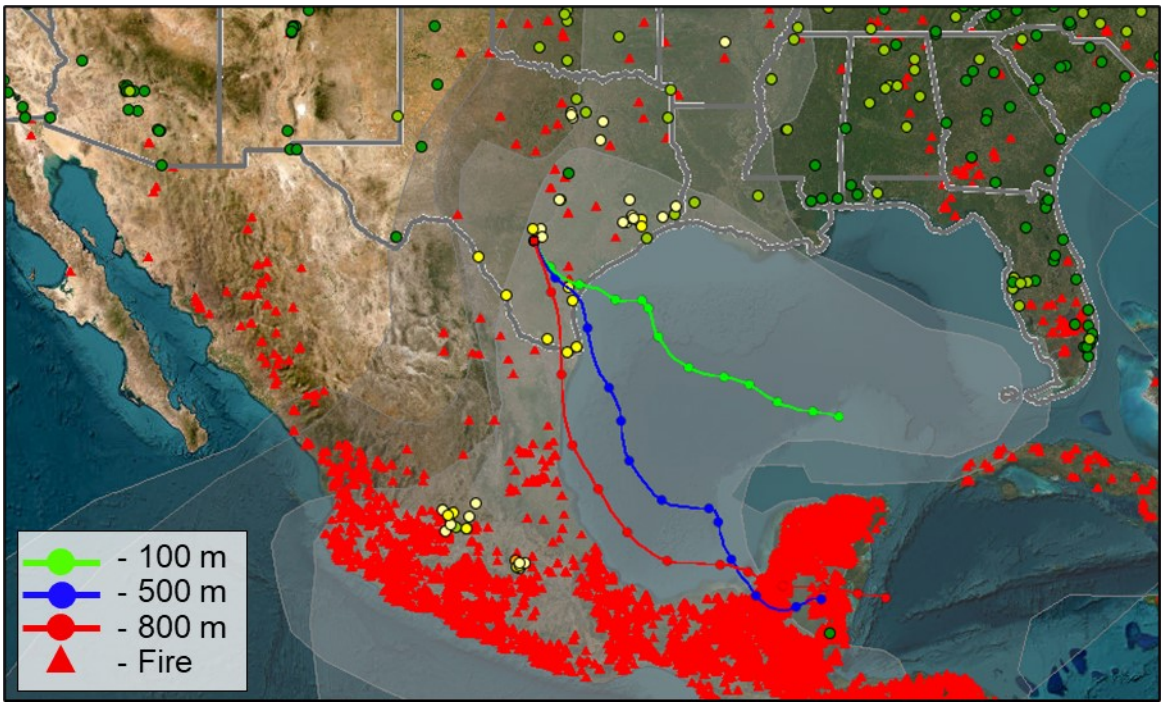

Figure 3-49: AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the Von Ormy Highway 16 Monitor on May 6, 2023

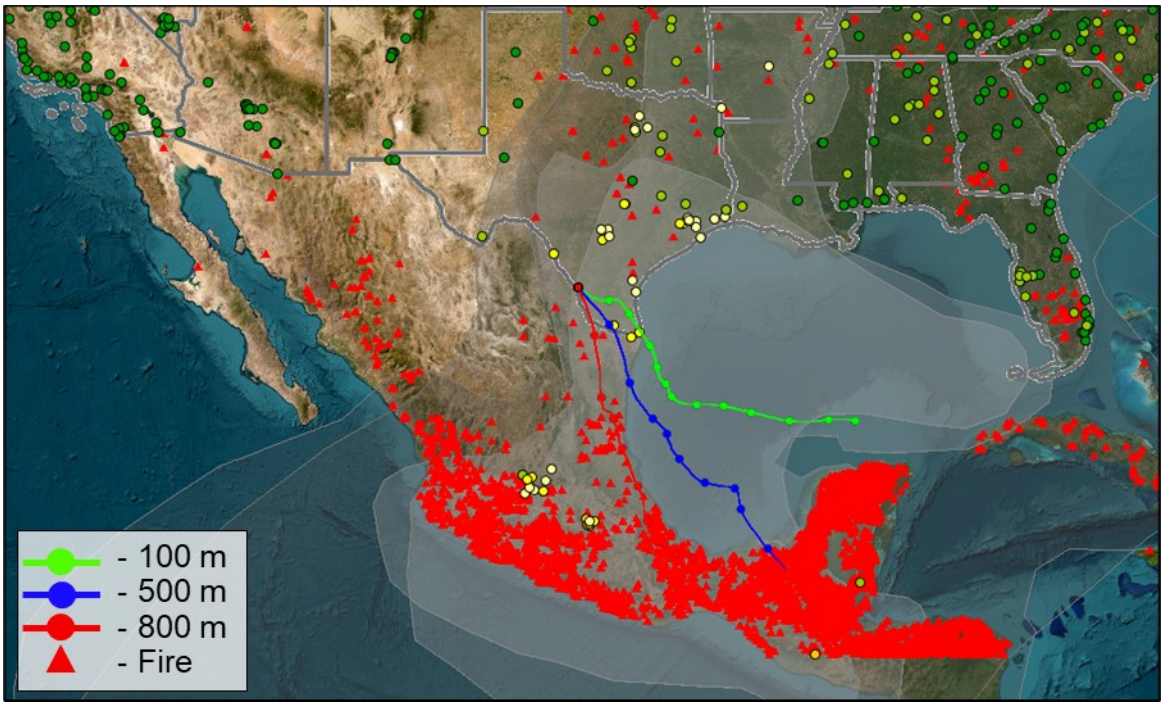

Figure 3-50: AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the World Trade Bridge Monitor on May 6, 2023

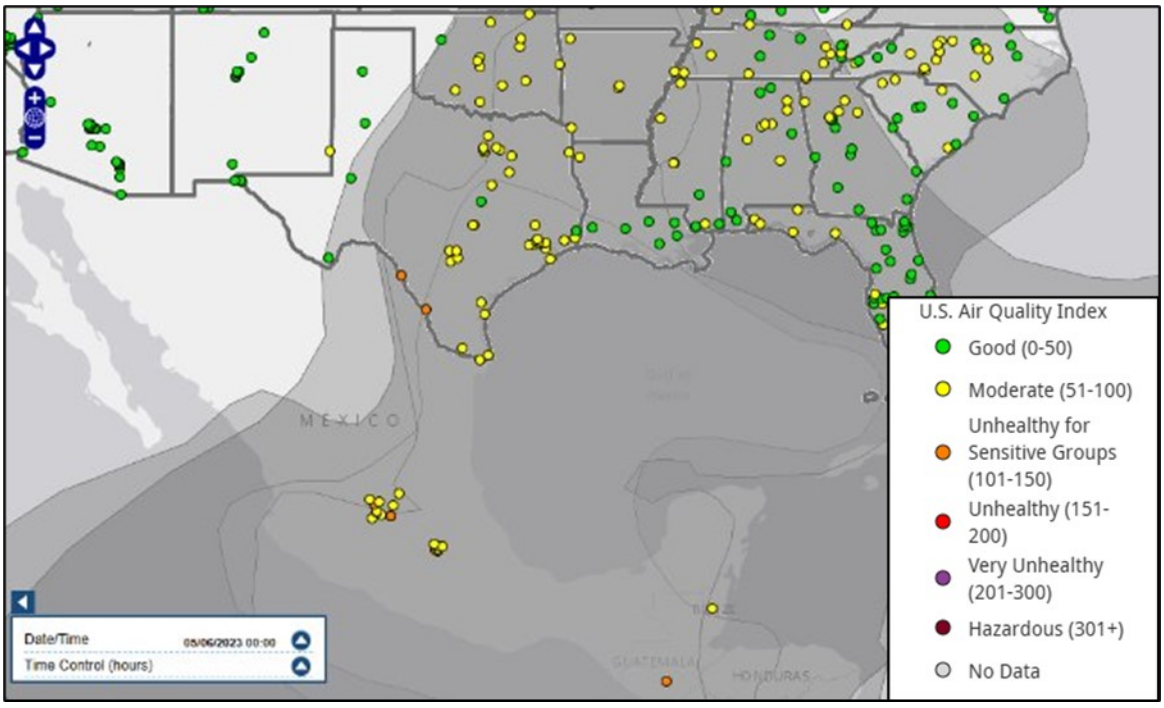

Figure 3-51: AirNow HMS Smoke Plume for May 6, 2023

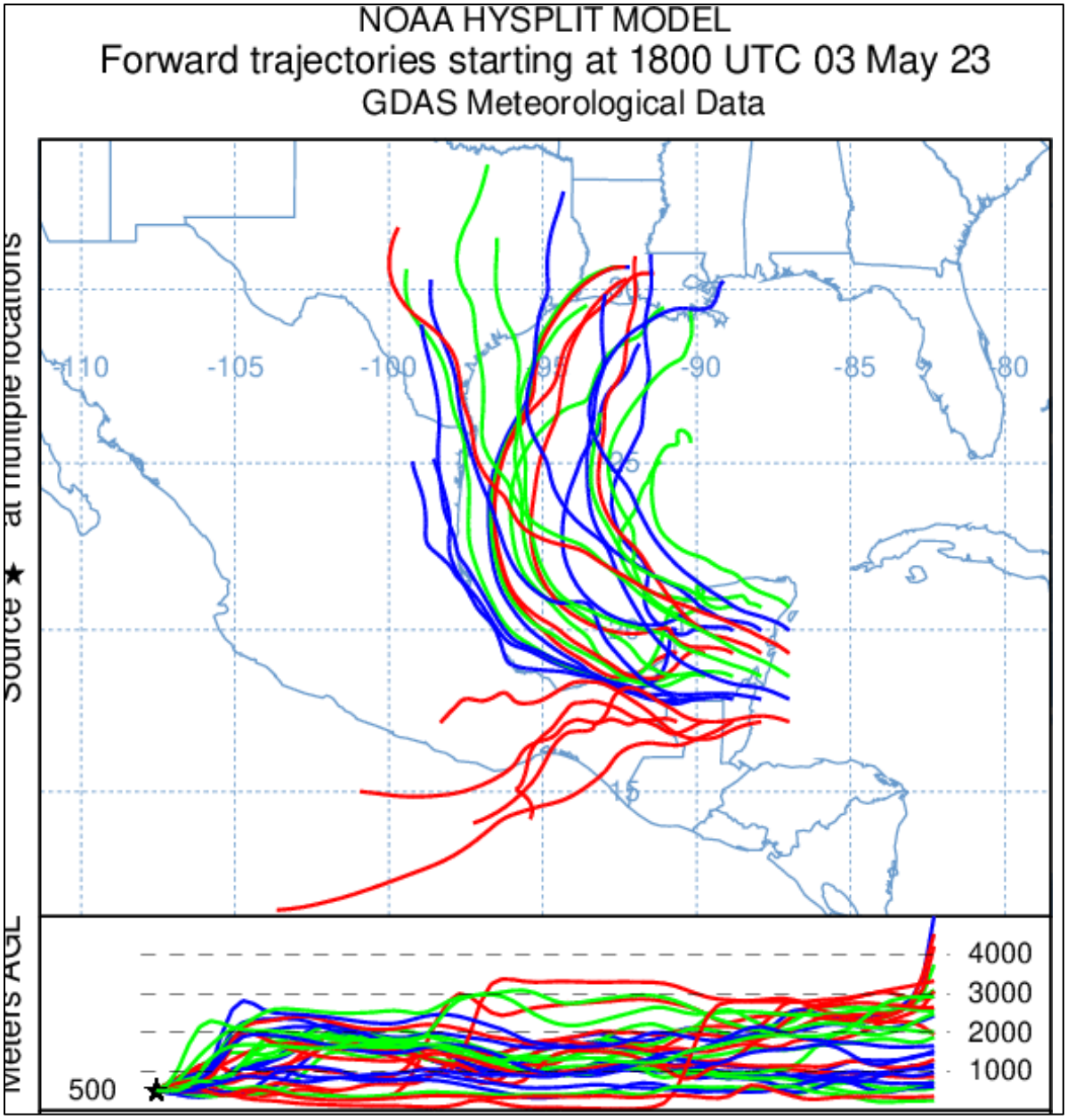

Figure 3-52: NOAA HYSPLIT 72-Hour Forward Trajectories Originating from Mexico Starting on May 3, 2023

3.2.8 Group 8 – Evidence for the May 11 and May 12, 2023, Fire (Mexico/Central America) $PM_{2.5}$ Event for the Edinburg East Freddy Gonzalez Drive, Haws Athletic Center, and World Trade Bridge Monitors

May 11, 2023, was identified as a Tier 1 day at the Edinburg East Freddy Gonzalez drive monitor, with a 24-hr concentration of 30.3 µg/m^3. May 12, 2023, was identified as a Tier 1 day for the Edinburg East Freddy Gonzalez Drive and World Trade Bridge monitors, and a Tier 2 day for the Haws Athletic Center monitor, with concentrations of 32.9 µg/m^3, 38.7 µg/m^3, and 24.6 µg/m^3 respectively.

On May 11, 2023, hourly $PM_{2.5}$ concentrations are compared against typical values Figure 3-53: *Hourly $PM_{2.5}$ Concentrations on May 11, 2023, Compared to Typical Concentrations at the Edinburg East Freddy Gonzalez Drive Monitor*. Back trajectories from the monitor shows transport of air from fire regions in Mexico (Figure 3-54: *AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the East Freddy Gonzalez Drive Monitor on May 11, 2023*). The AQI level was in the Moderate range at monitors around Brownsville, Texas, with layers of smoke denoted in the same area (Figure 3-55: *AirNow HMS Smoke Plume for May 11, 2023*). The TCEQ forecast discussion (Table C-8) mentions a huge mass of thin to moderate density smoke from ongoing significant seasonal fire activity along with some wildfires in Mexico and Central America.

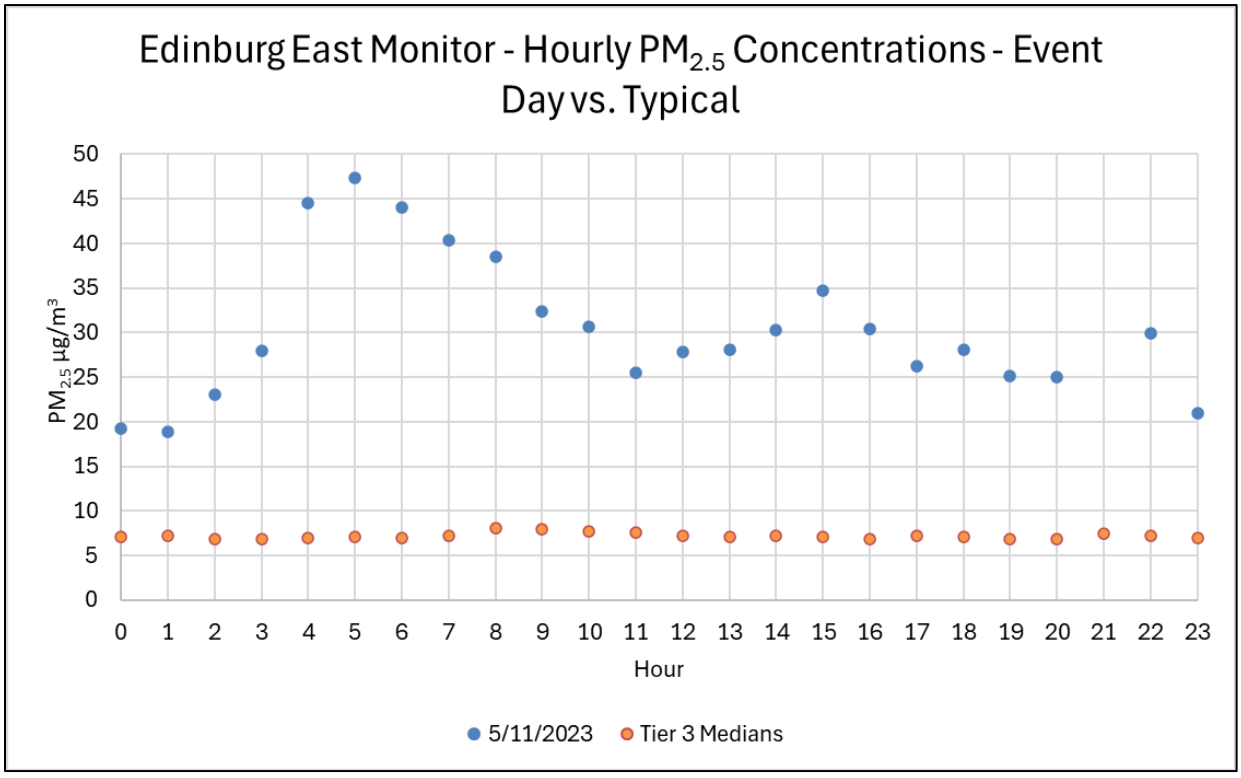

Figure 3-53: Hourly $PM_{2.5}$ Concentrations on May 11, 2023, Compared to Typical Concentrations at the Edinburg East Freddy Gonzalez Drive Monitor

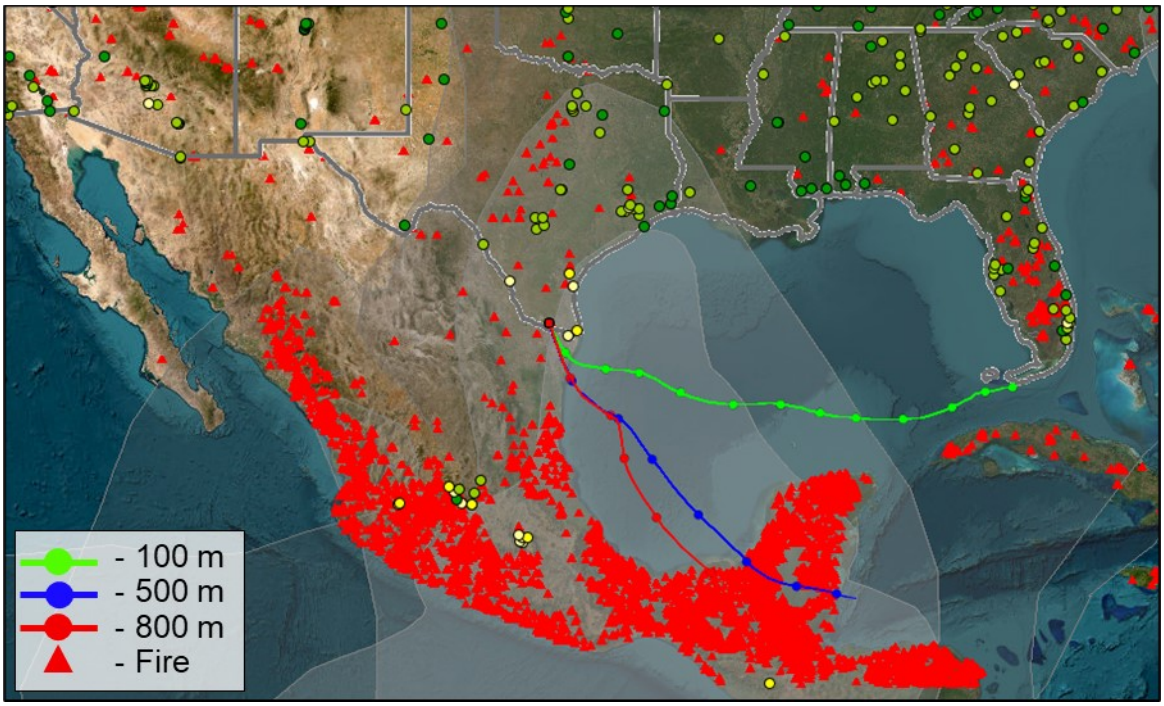

Figure 3-54: AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the East Freddy Gonzalez Drive Monitor on May 11, 2023

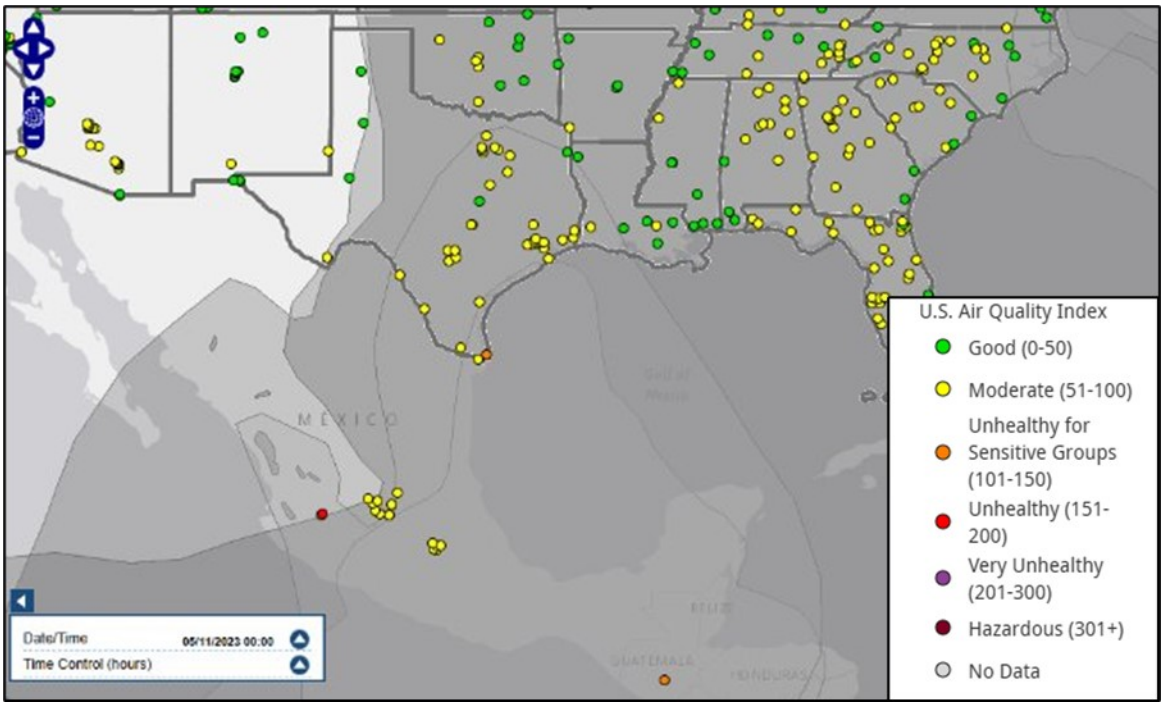

Figure 3-55: AirNow HMS Smoke Plume for May 11, 2023

On May 12, hourly $PM_{2.5}$ concentrations are compared against typical values in Figure 3-56: *Hourly $PM_{2.5}$ Concentrations on May 12, 2023, Compared to Typical Concentrations at the Edinburg East Freddy Gonzalez Drive Monitor*, Figure 3-57: *Hourly $PM_{2.5}$ Concentrations on May 12, 2023, Compared to Typical Concentrations at the World Trade Bridge Monitor*, and Figure 3-58: *Hourly $PM_{2.5}$ Concentrations on May 12, 2023, Compared to Typical Concentrations at the*

Haws Athletic Center Monitor. Back trajectories from the monitors shows transport of air from fire regions in Mexico (Figure 3-59: *AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the East Freddy Gonzalez Drive Monitor on May 12, 2023*, Figure 3-60: *AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the World Trade Bridge Monitor on May 12, 2023*, and Figure 3-61: *AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the Haws Athletic Center Monitor on May 12, 2023*). Moderate to Unhealthy AQI levels are denoted at monitors in South Texas on this day, with layers of smoke denoted in the same area (Figure 3-62: *AirNow HMS Smoke Plume for May 12, 2023*). The TCEQ forecast discussion (Table C-8) mentions a huge plume of moderate to heavy density smoke across most of the state from ongoing significant seasonal fire activity in Mexico and Central America.

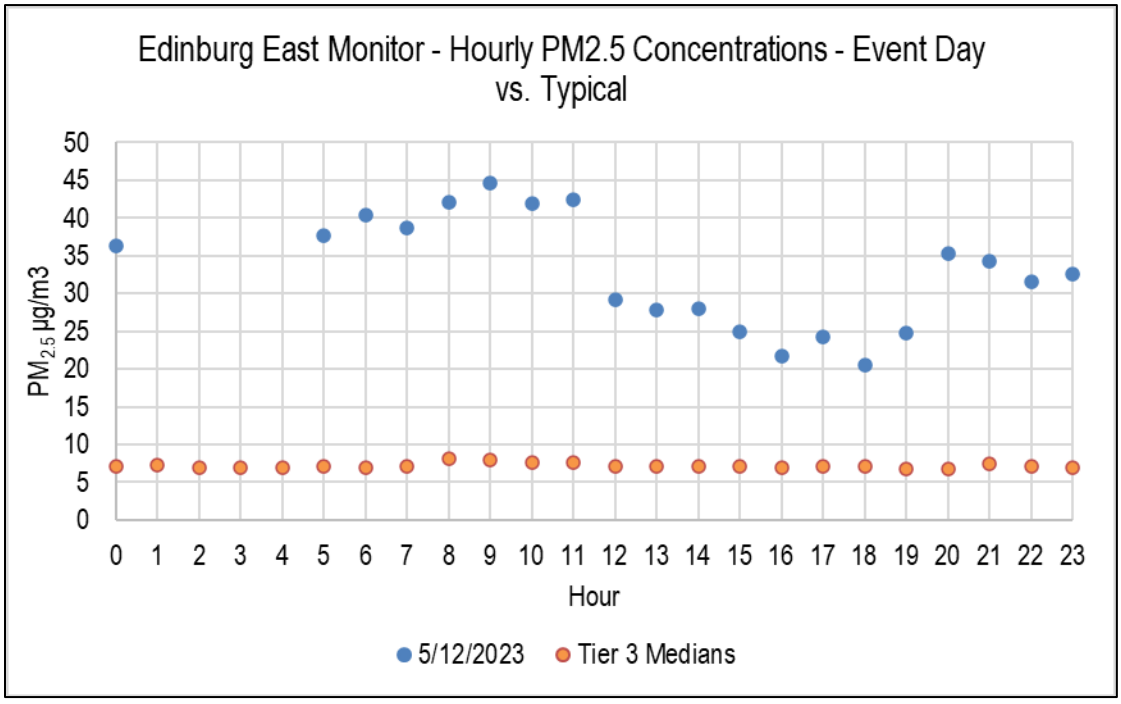

Figure 3-56: Hourly $PM_{2.5}$ Concentrations on May 12, 2023, Compared to Typical Concentrations at the Edinburg East Freddy Gonzalez Drive Monitor

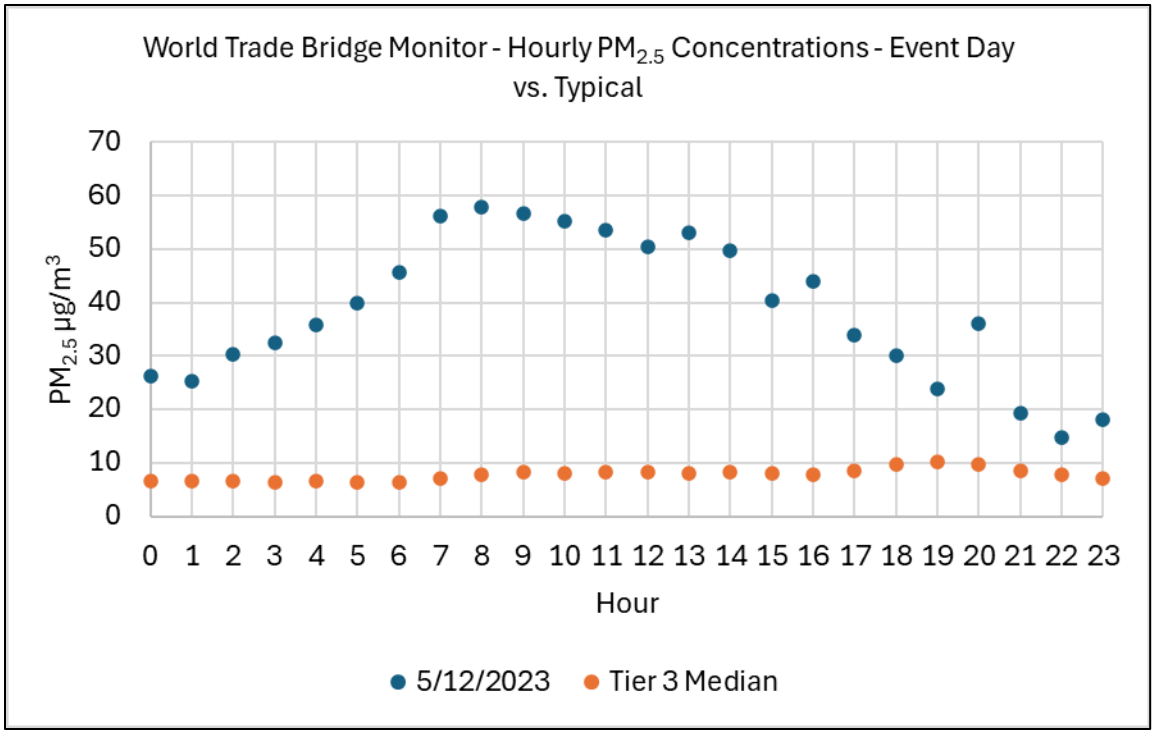

Figure 3-57: Hourly $PM_{2.5}$ Concentrations on May 12, 2023, Compared to Typical Concentrations at the World Trade Bridge Monitor

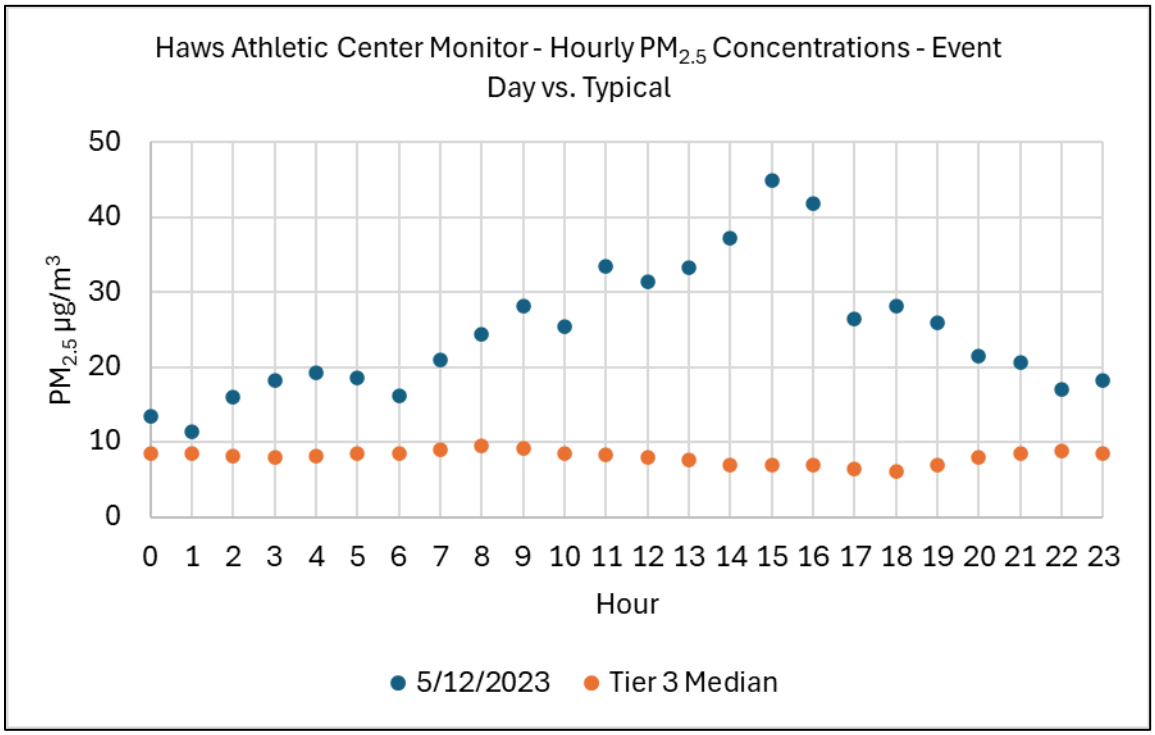

Figure 3-58: Hourly $PM_{2.5}$ Concentrations on May 12, 2023, Compared to Typical Concentrations at the Haws Athletic Center Monitor

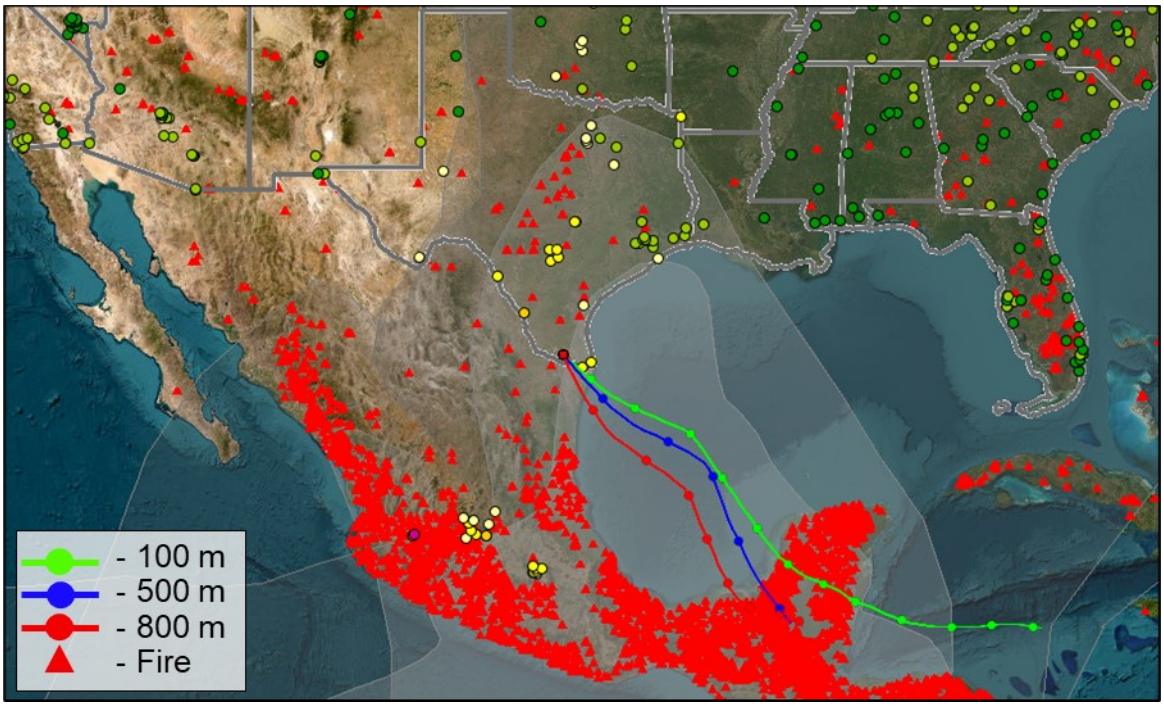

Figure 3-59: AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the East Freddy Gonzalez Drive Monitor on May 12, 2023

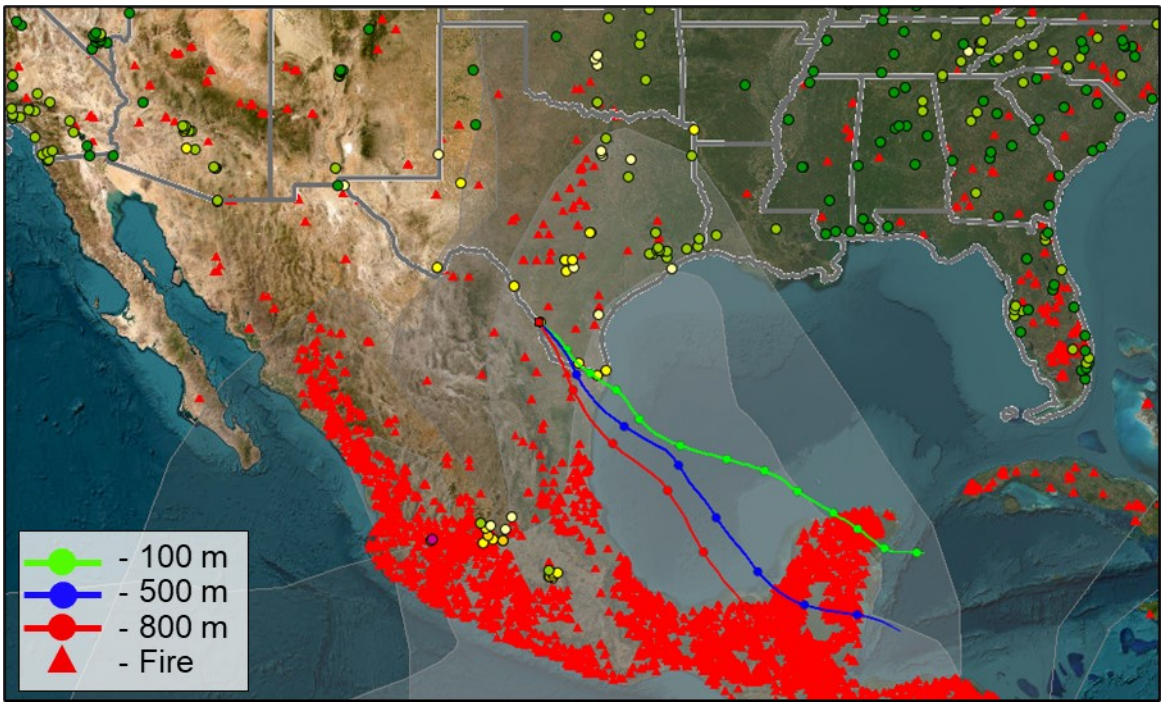

Figure 3-60: AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the World Trade Bridge Monitor on May 12, 2023

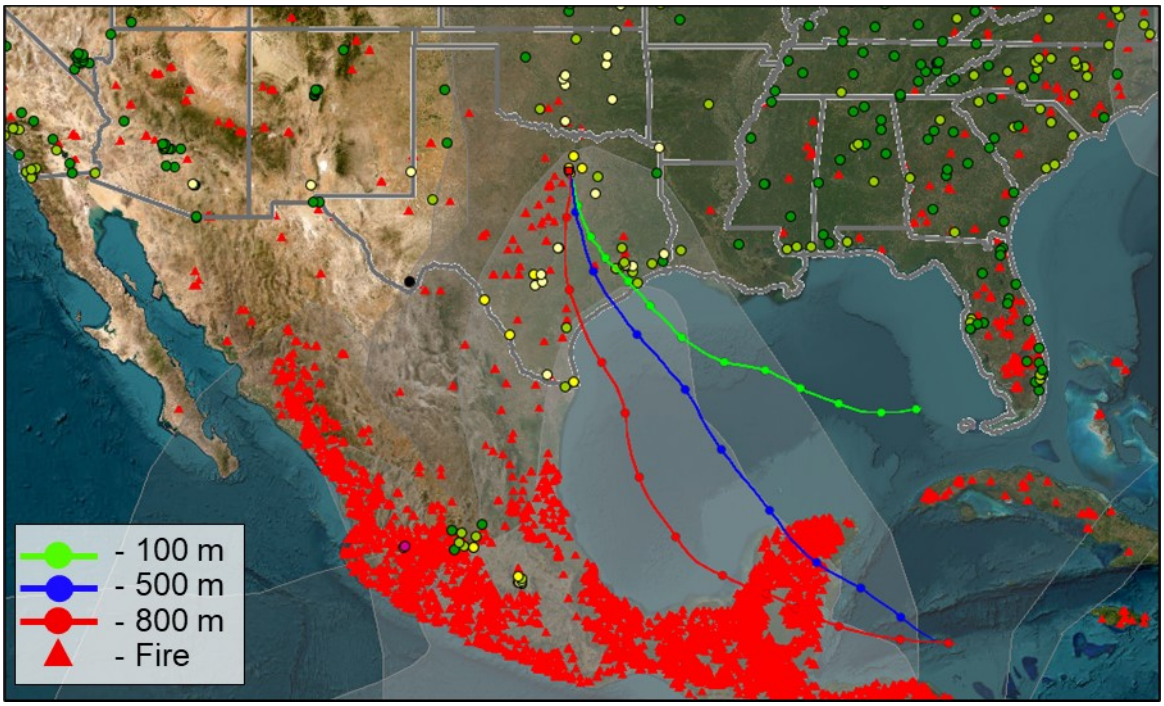

Figure 3-61: AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the Haws Athletic Center Monitor on May 12, 2023

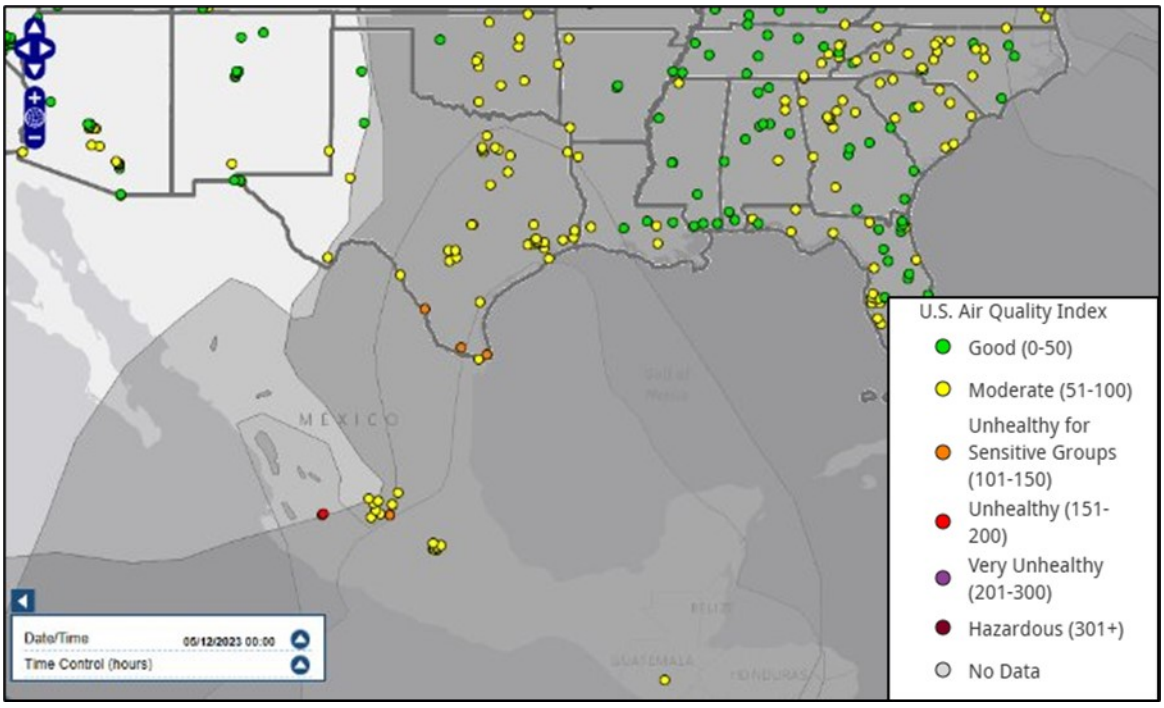

Figure 3-62: AirNow HMS Smoke Plume for May 12, 2023

3.2.9 Group 9 – Evidence for the June 14, June 15, and June 16, 2023, Fire (Mexico/Central America) $PM_{2.5}$ Event for the Haws Athletic Center and World Trade Bridge Monitors

June 14, 15, and 16 were identified as Fire (Mexico) days for the Haws Athletic Center and World Trade bridge monitors:

- June 14, 2023, was identified as a Tier 1 day for the Haws Athletic Center. The 24-hr average concentration on this day was 25.0 µg/m^3, and the elevated concentrations were due to smoke from fires in Mexico.
- June 15, 2023 was identified as a Tier 1 day for both the Haws Athletic Center monitor and the World Trade Bridge monitor, again due to smoke from fires in Mexico. The 24-hr concentrations were 27.8 µg/m^3 and 33.1 µg/m^3 respectively.
- June 16, 2023 was identified as a Tier 2 day for the World Trade Bride monitor due to smoke effects from fires in Mexico. The 24-hr average concentration on this day was 28.8 µg/m^3.

For June 14, the hourly $PM_{2.5}$ concentrations at the Haws Athletic Center monitor are compared with Tier 3 typical values in Figure 3-63: *Hourly $PM_{2.5}$ Concentrations on June 14, 2023, Compared to Typical Concentrations at the Haws Athletic Center Monitor*. Air at higher levels was transported from the Gulf near fire areas along the Mexican coast (Figure 3-64: *AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the Haws Athletic Center Monitor on June 14, 2023*). The TCEQ forecast mentions light to moderate residual smoke from seasonal burning expanding north into South, Central, and North-Central Texas (Table C-9), and the elevated smoke levels lead to Moderate AQI levels at the Haws Athletic Center monitor (Figure 3-65: *AirNow HMS Smoke Plume for June 14, 2023*). Local media reports on this day describe the poorer visibility in Texas due to ongoing agriculture burning in Mexico and hazy conditions in various parts of the state (Figures C-6, C-7, and C-8).

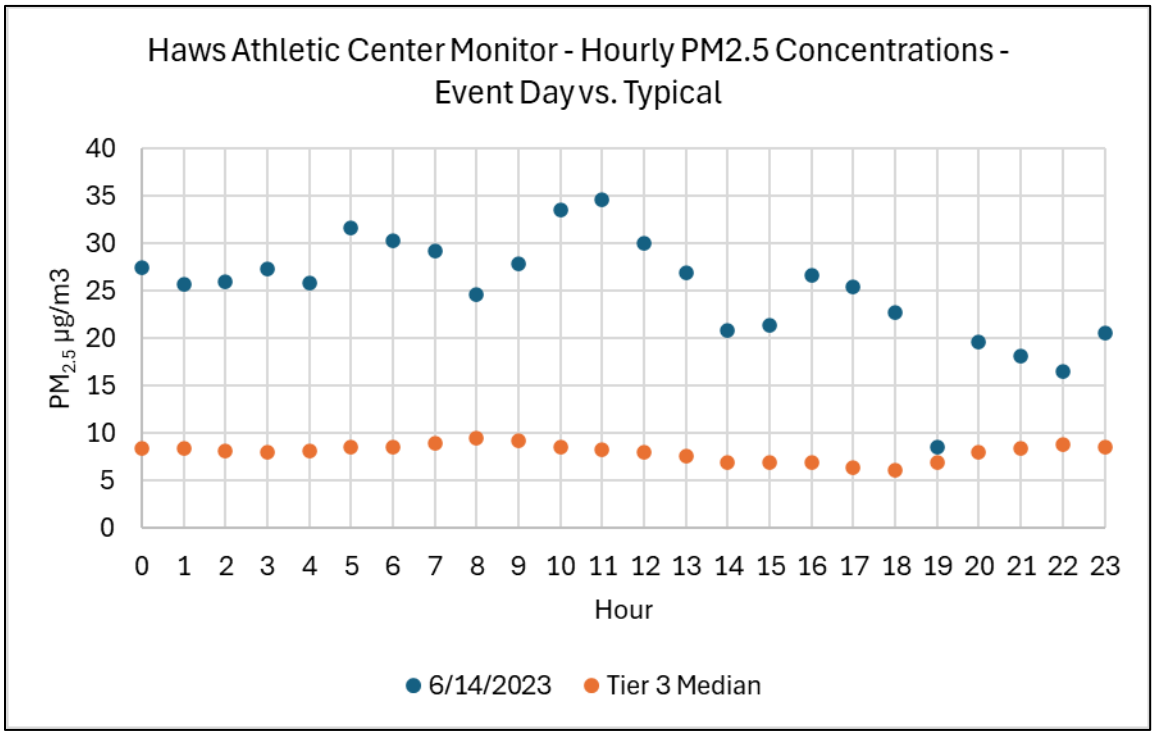

Figure 3-63: Hourly $PM_{2.5}$ Concentrations on June 14, 2023, Compared to Typical Concentrations at the Haws Athletic Center Monitor

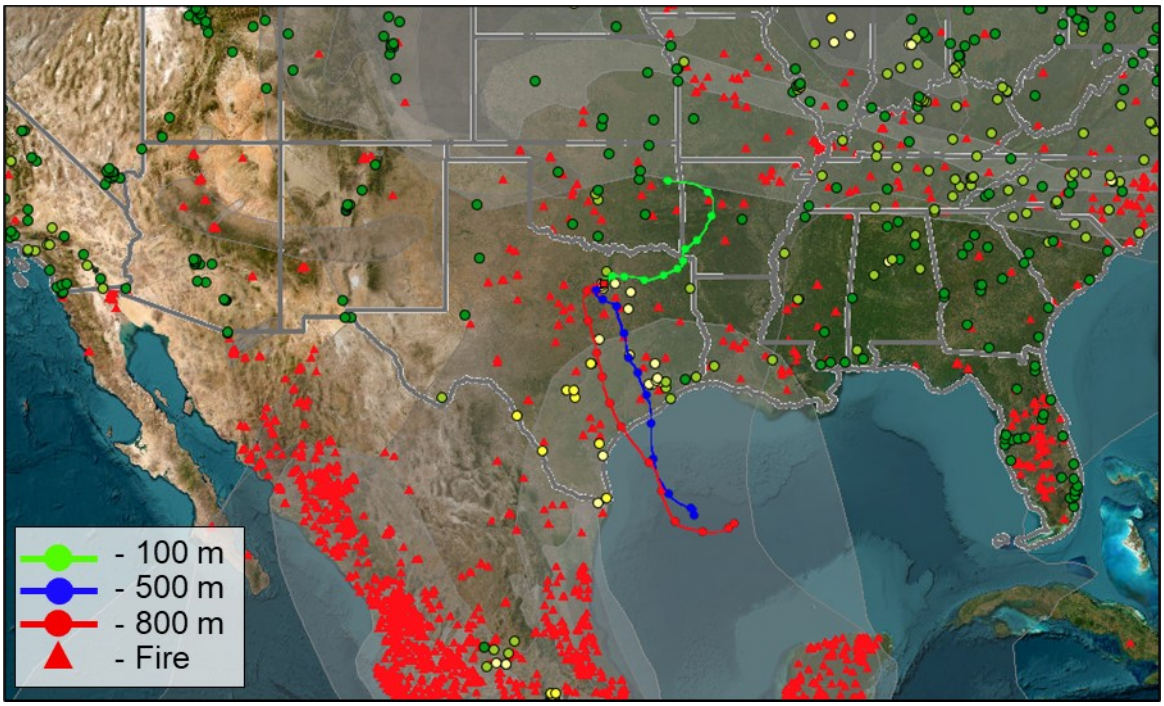

Figure 3-64: AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the Haws Athletic Center Monitor on June 14, 2023

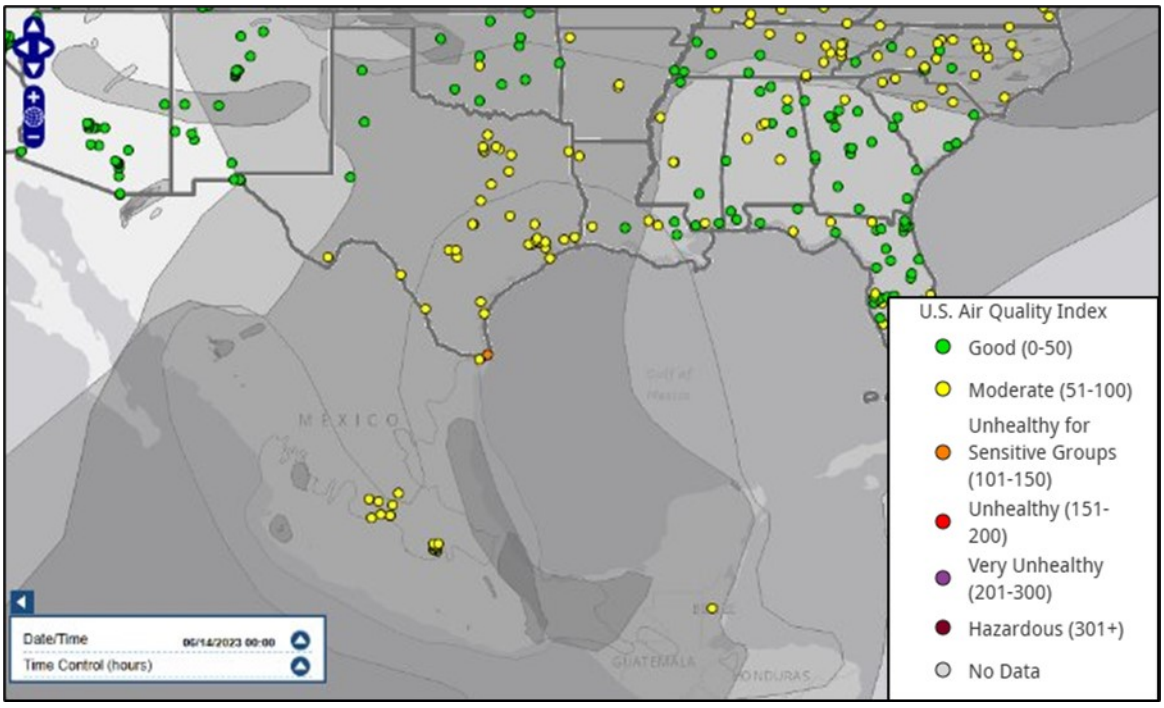

Figure 3-65: AirNow HMS Smoke Plume for June 14, 2023

On June 15, hourly $PM_{2.5}$ concentrations are compared against typical values in Figure 3-66: *Hourly $PM_{2.5}$ Concentrations on June 15, 2023, Compared to Typical Concentrations at the Haws Athletic Center Monitor* and Figure 3-67: *Hourly $PM_{2.5}$ Concentrations on June 15, 2023, Compared to Typical Concentrations at the World Trade Bridge Monitor*. Back trajectories from both monitors show transport of air from fire regions in Mexico (Figure 3-68: *AirNow Tech*

HYSPLIT 72-Hour Back Trajectories Originating from the Haws Athletic Center Monitor on June 15, 2023 and Figure 3-69: *AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the World Trade Bridge Monitor on June 15, 2023*). The AQI was in the Moderate range at Central and South Texas monitors on this day, with layers of light to medium smoke denoted in the same area (Figure 3-70: *AirNow HMS Smoke Plume for June 15, 2023*). The TCEQ forecast discussion (Table C-9) mentions the smoke from the fires in Mexico and Central America merging with smoke from the Canadian wildfires over the South-Central U.S.

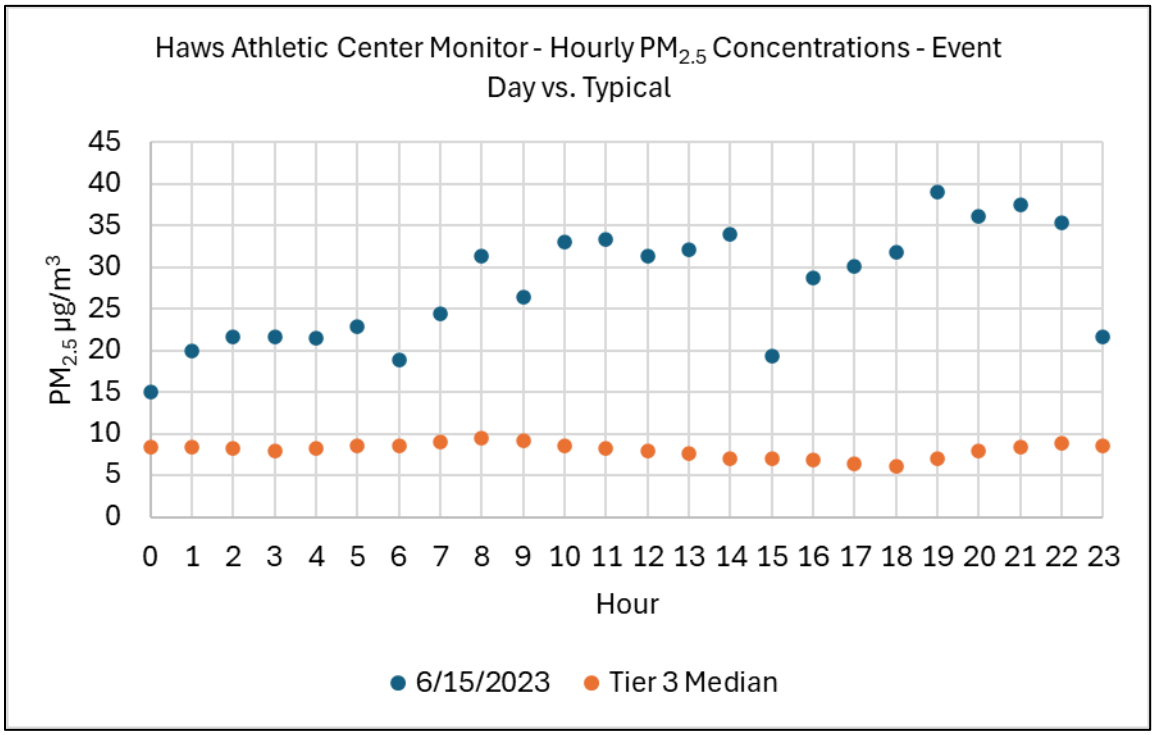

Figure 3-66: Hourly $PM_{2.5}$ Concentrations on June 15, 2023, Compared to Typical Concentrations at the Haws Athletic Center Monitor

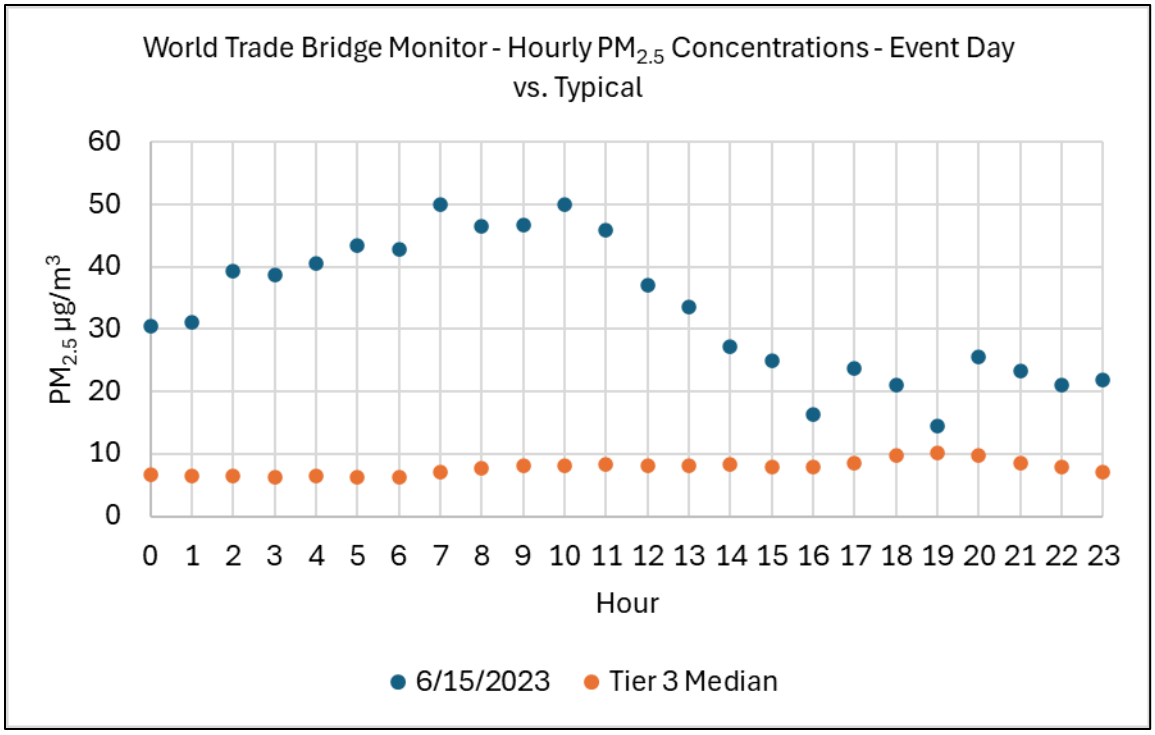

Figure 3-67: Hourly $PM_{2.5}$ Concentrations on June 15, 2023, Compared to Typical Concentrations at the World Trade Bridge Monitor

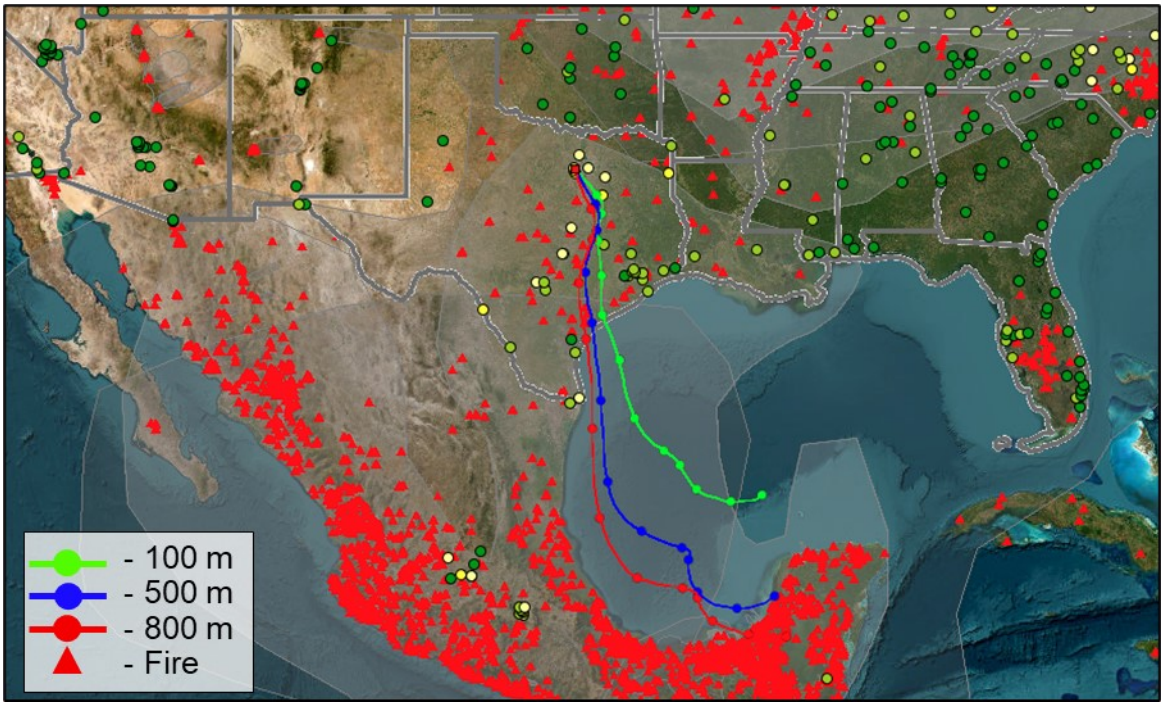

Figure 3-68: AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the Haws Athletic Center Monitor on June 15, 2023

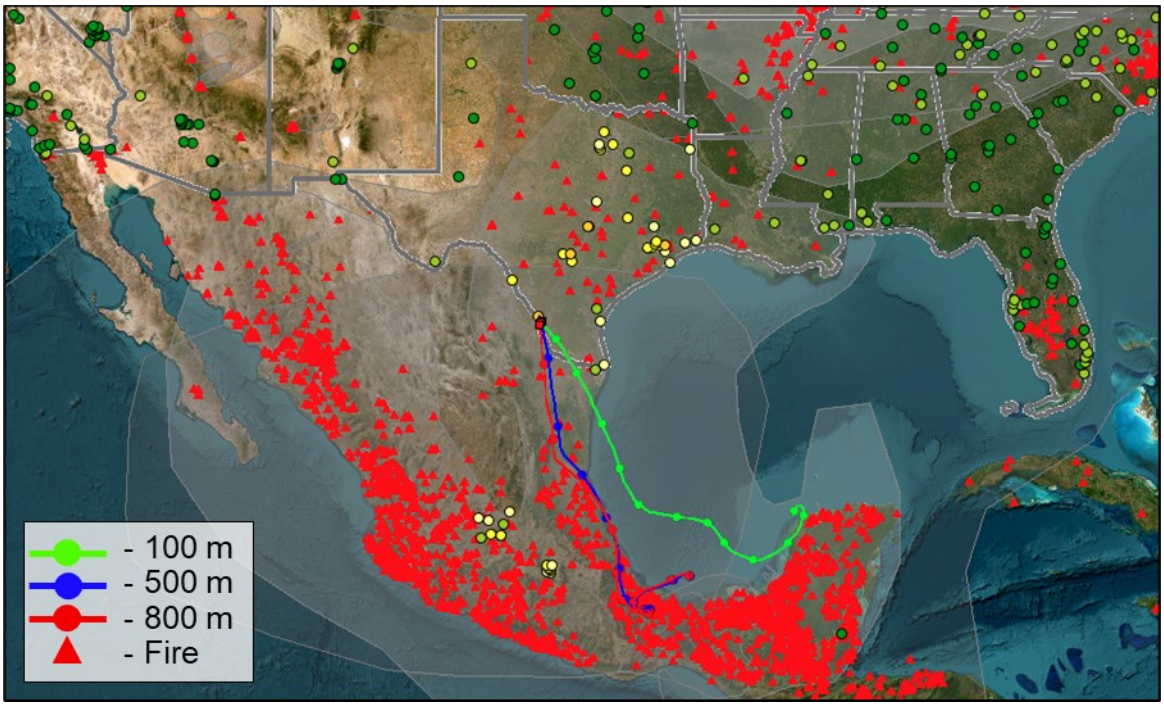

Figure 3-69: AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the World Trade Bridge Monitor on June 15, 2023

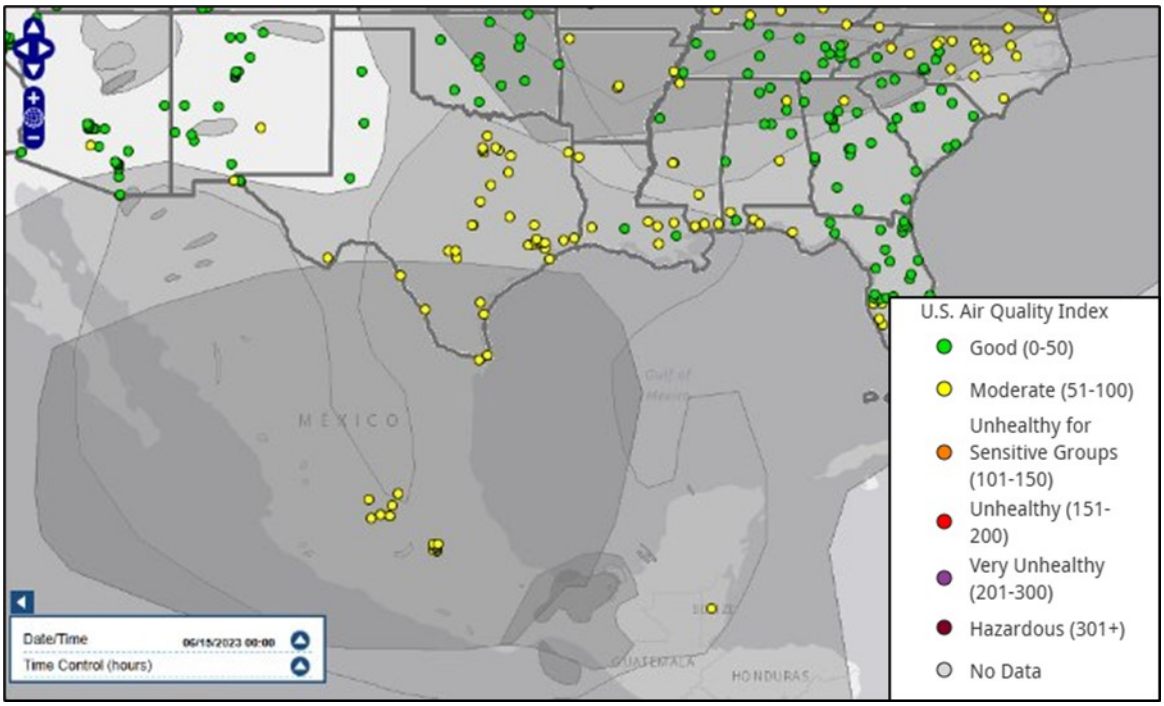

Figure 3-70: AirNow HMS Smoke Plume for June 15, 2023

For June 16, the hourly $PM_{2.5}$ concentrations at the World Trade Bridge monitor are compared with Tier 3 typical values in Figure 3-71: *Hourly $PM_{2.5}$ Concentrations on June 16, 2023, Compared to Typical Concentrations at the World Trade Bridge Monitor*. Air at higher levels was transported from the Gulf near fire areas along the Mexican coast (Figure 3-72: *AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the World Trade Bridge Monitor on June*

16, 2023). The TCEQ forecast describes light residual smoke being transported from southern Mexico (Table C-9), and the elevated smoke levels lead to Moderate AQI levels at monitors (Figure 3-73: *AirNow HMS Smoke Plume for June 16, 2023*).

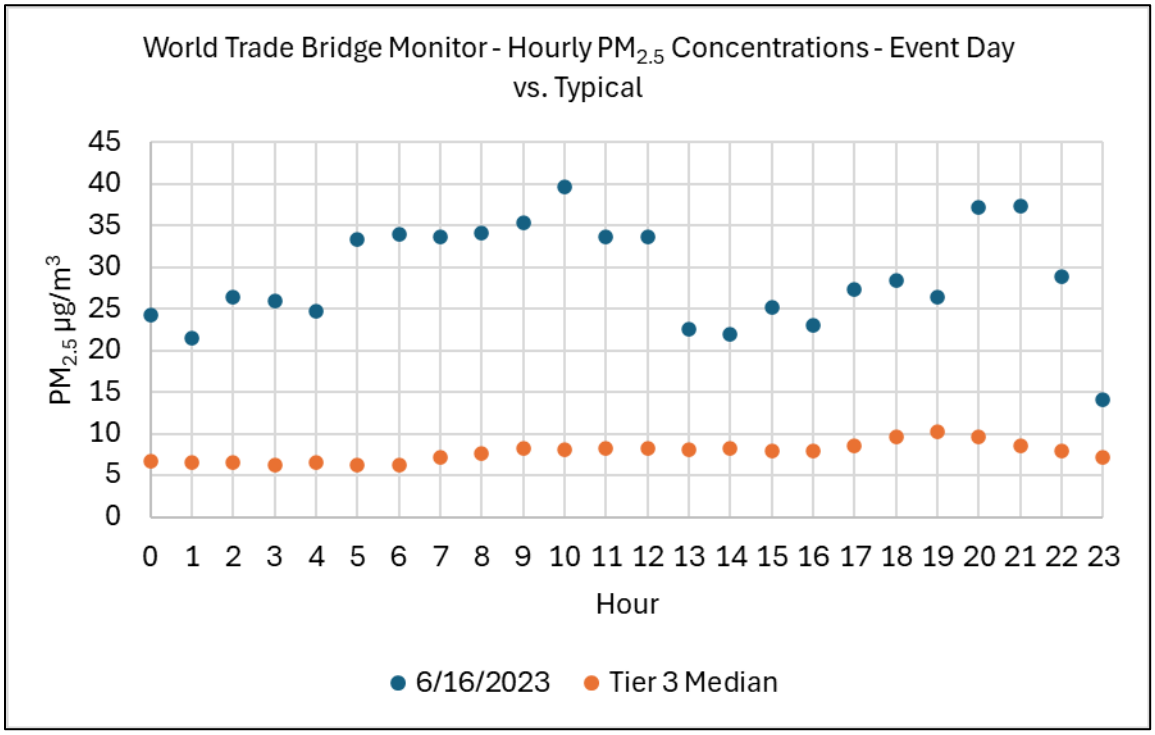

Figure 3-71: Hourly $PM_{2.5}$ Concentrations on June 16, 2023, Compared to Typical Concentrations at the World Trade Bridge Monitor

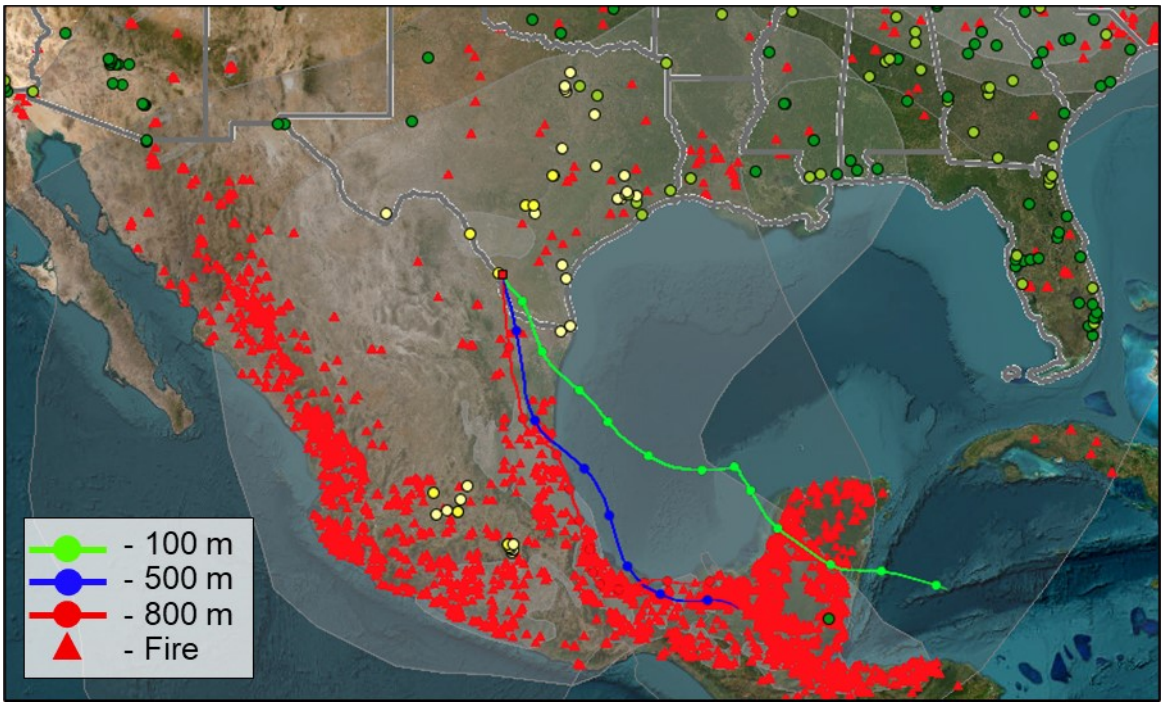

Figure 3-72: AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the World Trade Bridge Monitor on June 16, 2023

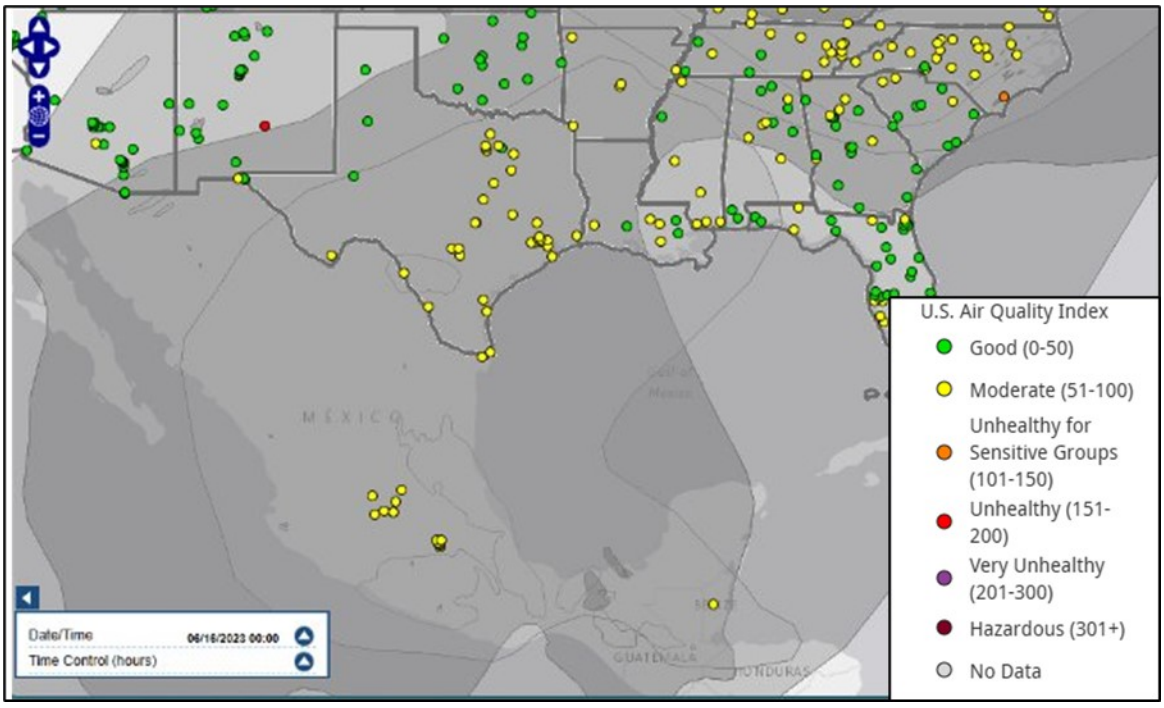

Figure 3-73: AirNow HMS Smoke Plume for June 16, 2023

3.2.10 Group 10 – Evidence for the July 15 and July 16, 2023, African Dust Event for the Edinburg East Freddy Gonzalez Drive Monitor

July 15 and July 16 were identified as Tier 2 days at the Edinburg East Freddy Gonzalez Drive monitor, with 24-hr $PM_{2.5}$ concentrations of 23.4 µg/m^3 and 23.0 µg/m^3, respectively. These elevated concentrations were a result of Saharan dust transport.

For July 15, elevated hourly concentrations of $PM_{2.5}$ can be compared against Tier 3 median values in Figure 3-74: *Hourly $PM_{2.5}$ Concentrations on July 15, 2023, Compared to Typical Concentrations at the Edinburg East Freddy Gonzalez Drive Monitor*. Back trajectories (Figure 3-75: *AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the Edinburg East Freddy Gonzalez Drive Monitor on July 15, 2023)* and the aerosol optical depth (Figure 3-76: *AirNow Tech Aerosol Optical Depth (AOD) Map, with MODIS Terra and Aqua Satellite Layers on July 15, 2023*) show movement of air from the Caribbean, into the Gulf and into Texas. TCEQ forecasted (Table C-10) a light-to-moderate density plume of Saharan dust continuing to build over South-Central Texas. Saharan dust was also mentioned in media reports on these two days (Figures C-9 and C-10). Forward trajectories from West Africa (starting two weeks before the event day) show transport of dust across the Atlantic Ocean into North America (Figure 3-77: *NOAA HYSPLIT Forward Trajectories Originating from Western Africa, Starting on July 1, 2023*).

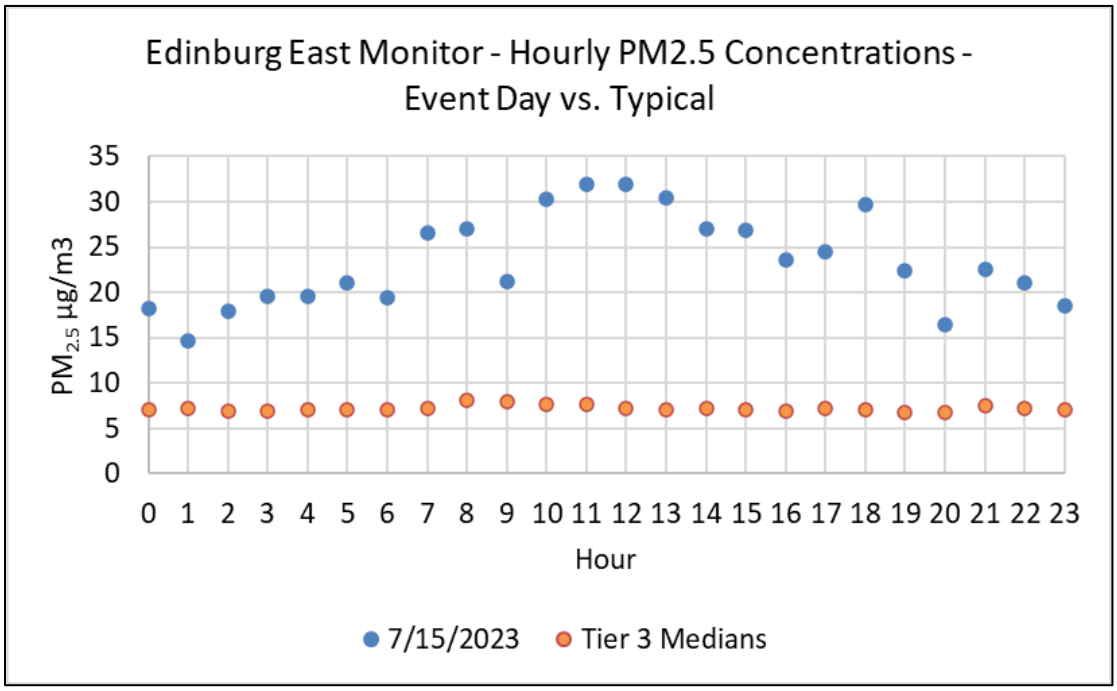

Figure 3-74: Hourly $PM_{2.5}$ Concentrations on July 15, 2023, Compared to Typical Concentrations at the Edinburg East Freddy Gonzalez Drive Monitor

Figure 3-75: AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the Edinburg East Freddy Gonzalez Drive Monitor on July 15, 2023

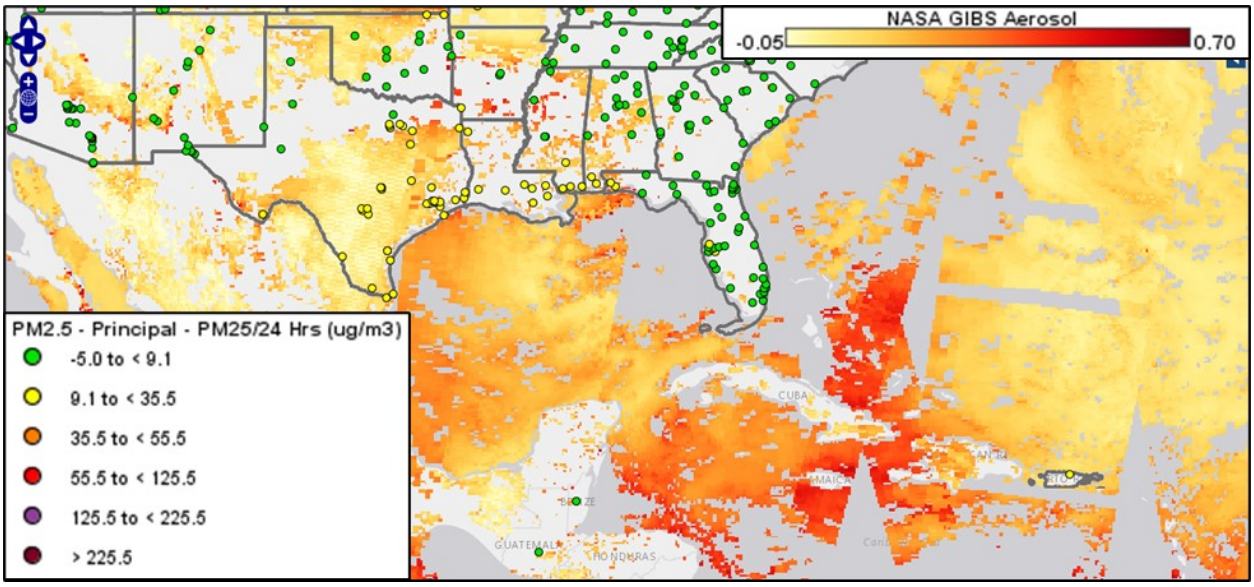

Figure 3-76: AirNow Tech Aerosol Optical Depth (AOD) Map, with MODIS Terra and Aqua Satellite Layers on July 15, 2023

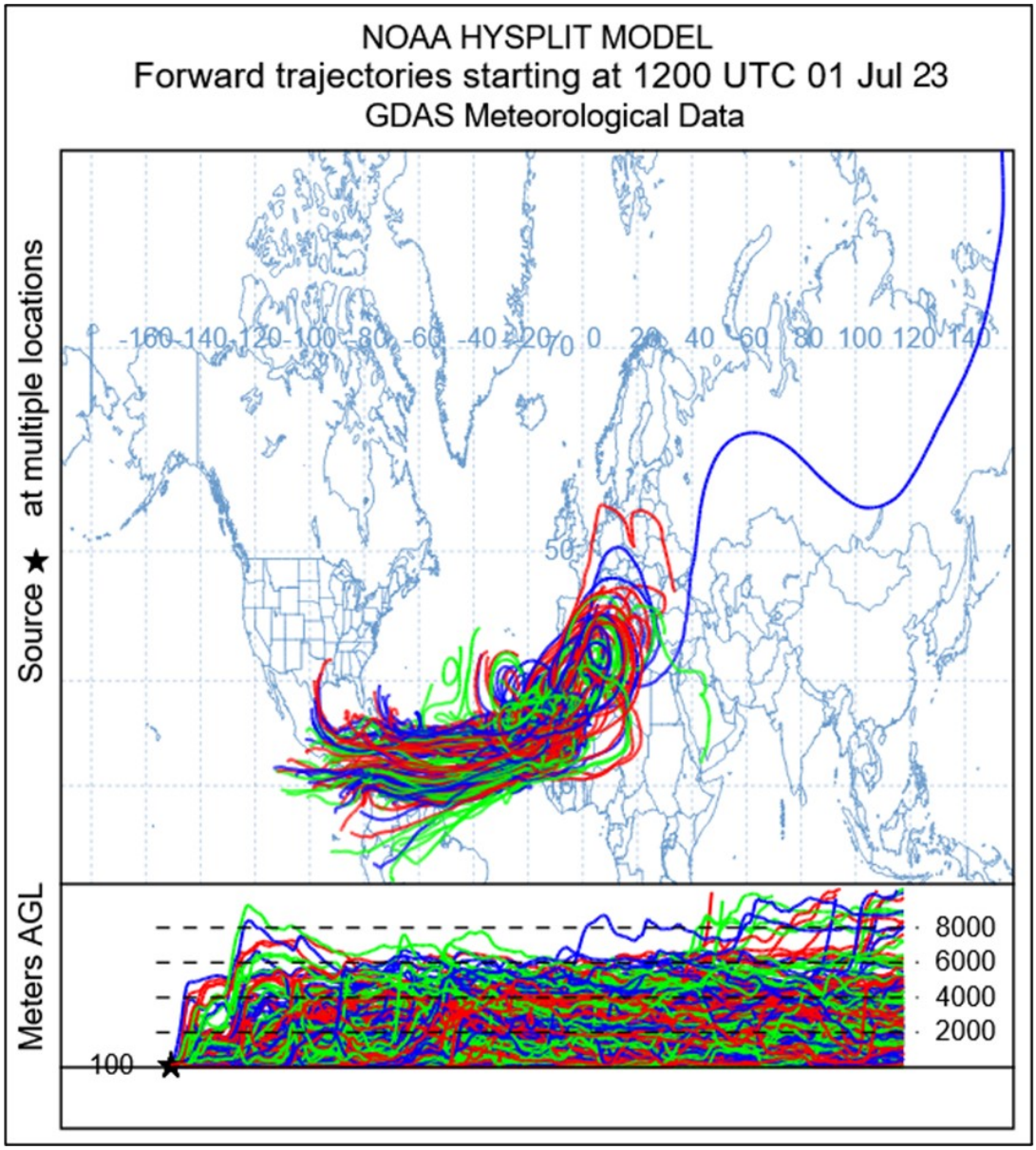

Figure 3-77: NOAA HYSPLIT Forward Trajectories Originating from Western Africa, Starting on July 1, 2023

For July 16, elevated hourly concentrations of $PM_{2.5}$ can be compared against Tier 3 median values in Figure 3-78: *Hourly $PM_{2.5}$ Concentrations on July 16, 2023, Compared to Typical Concentrations at the Edinburg East Freddy Gonzalez Drive Monitor*. Back trajectories (Figure 3-79: *AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the Edinburg East Freddy Gonzalez Drive Monitor on July 16, 2023*) and aerosol optical depth (Figure 3-80: *AirNow Tech Aerosol Optical Depth (AOD) Map, with MODIS Terra and Aqua Satellite Layers on July 16, 2023*) show movement of air from the Caribbean, into the Gulf and into Texas. Forward trajectories from West Africa (starting two weeks before the event day) show transport of dust across the Atlantic Ocean into North America (Figure 3-81: *NOAA HYSPLIT Forward Trajectories Originating from Western Africa, Starting on July 2, 2023*). The dust can be seen on visible satellite imagery being transported off the coast of Africa a few weeks before this EE grouping (Figure 3-82: *Aqua/MODIS Corrected Reflectance (True Color) Satellite Imagery from July 6,*

2023, Showing Dust Being Transported off the Western Coast of Africa). TCEQ also forecasted Saharan dust continuing to impact most spots in Texas at varying intensities (Table C-10).

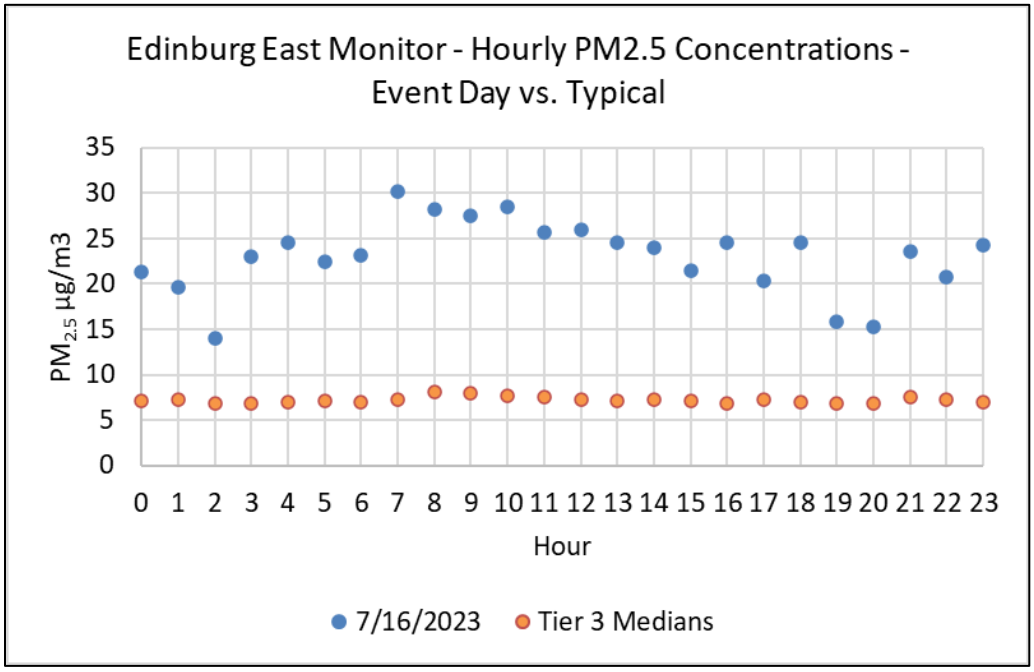

Figure 3-78: Hourly $PM_{2.5}$ Concentrations on July 16, 2023, Compared to Typical Concentrations at the Edinburg East Freddy Gonzalez Drive Monitor

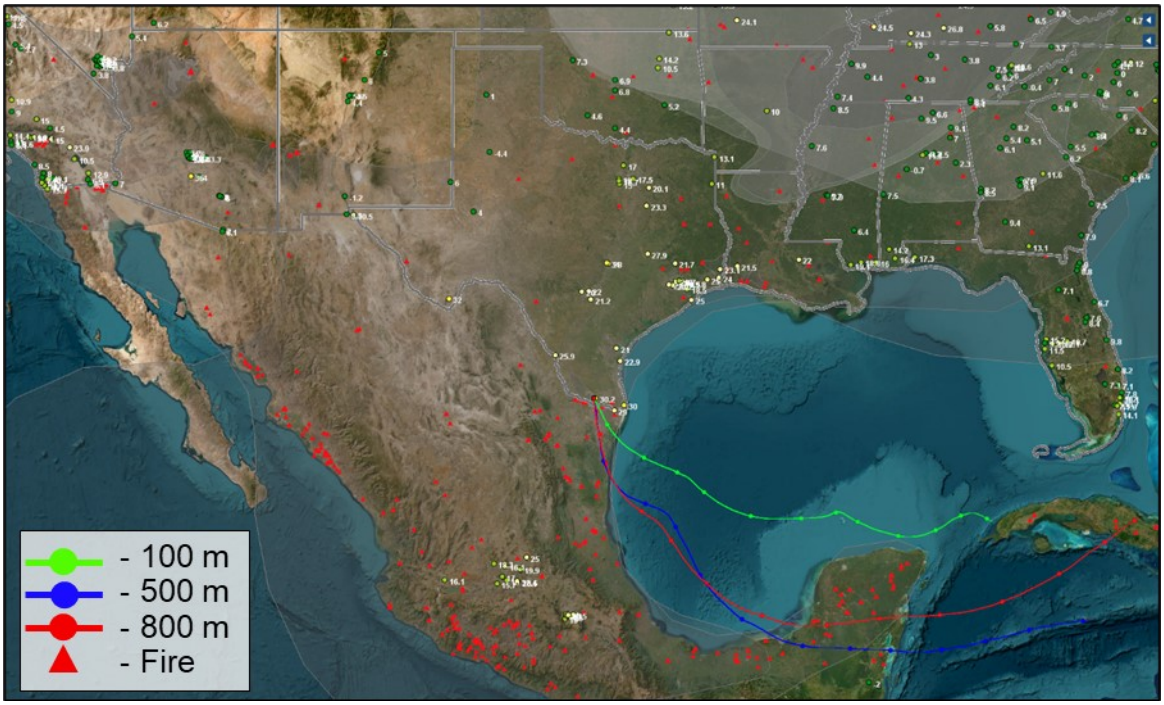

Figure 3-79: AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the Edinburg East Freddy Gonzalez Drive Monitor on July 16, 2023

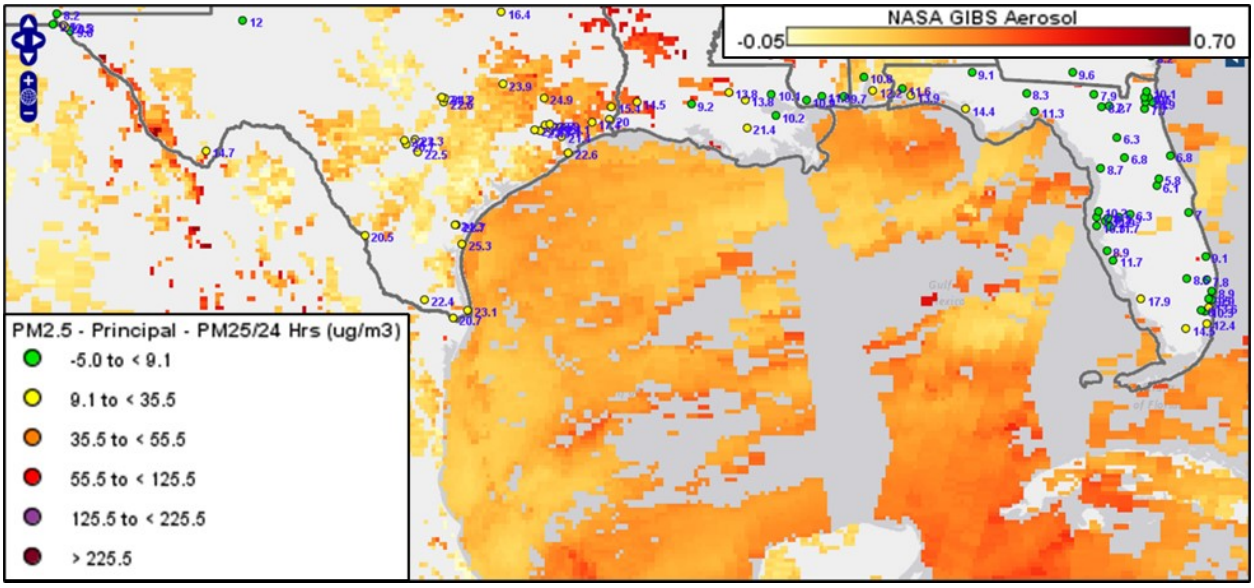

Figure 3-80: AirNow Tech Aerosol Optical Depth (AOD) Map, with MODIS Terra and Aqua Satellite Layers on July 16, 2023

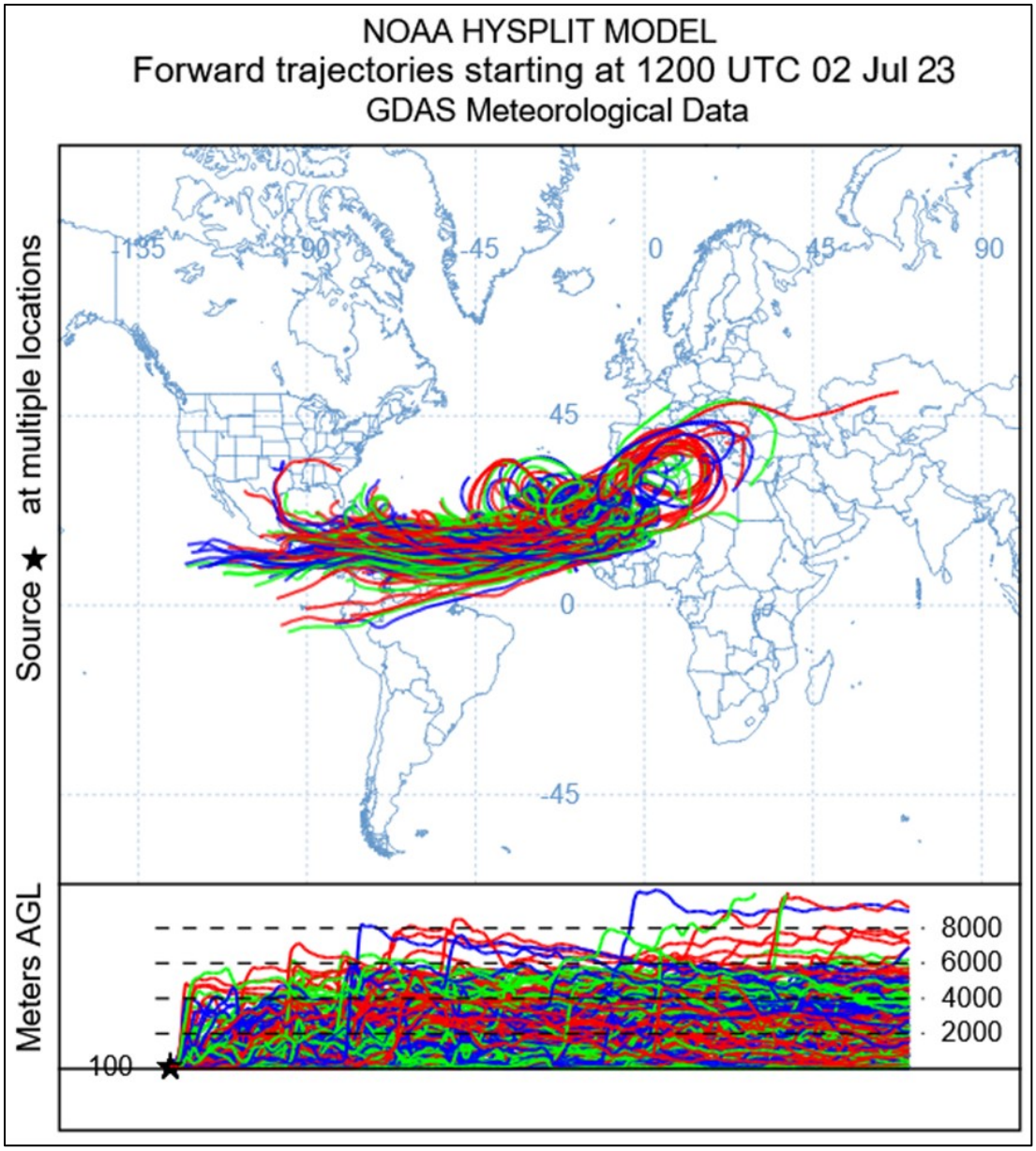

Figure 3-81: NOAA HYSPLIT Forward Trajectories Originating from Western Africa, Starting on July 2, 2023

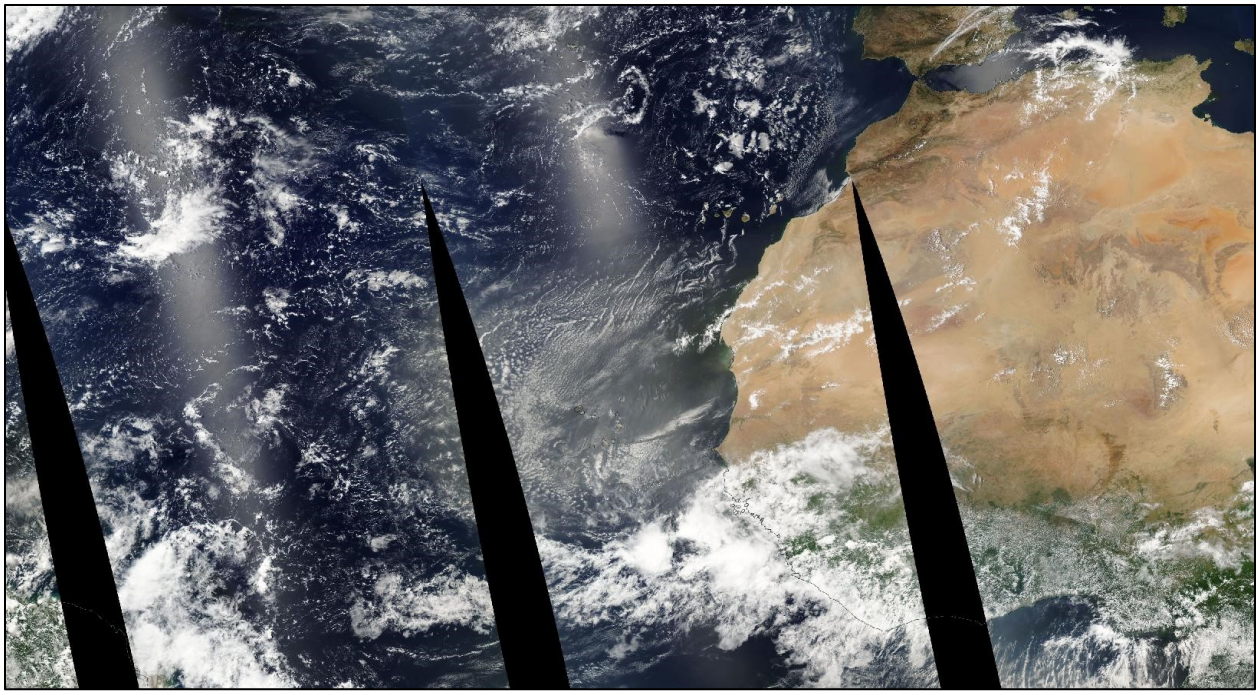

Figure 3-82: Aqua/MODIS Corrected Reflectance (True Color) Satellite Imagery from July 6, 2023, Showing Dust Being Transported off the Western Coast of Africa

3.2.11 Group 11 – Evidence for the July 26 and July 27, 2023, African Dust $PM_{2.5}$ Event for the Edinburg East Freddy Gonzalez Drive Monitor

July 26 and July 27, 2023, were identified as Tier 2 days at the Edinburg East Freddy Gonzalez Drive monitor, with 24-hr $PM_{2.5}$ concentrations of 26.1 µg/m^3 and 27.1 µg/m^3, respectively. These elevated concentrations were a result of Saharan dust.

For July 26, elevated concentrations of $PM_{2.5}$ can be compared against Tier 3 median values in Figure 3-83: *Hourly $PM_{2.5}$ Concentrations on July 26, 2023, Compared to Typical Concentrations at the Edinburg East Freddy Gonzalez Drive Monitor*. The TCEQ forecast discusses residual smoke from the Canadian wildfires with light amounts reaching the surface, and the Saharan dust plume was expected to continue to build (Table C-11). Media reports from San Antonio and Corpus Christi describe the Saharan dust moving into Texas and causing hazy conditions (Figures C-11, C-12, and C-13). Back trajectories show movement of air from the Caribbean into the Gulf and the Texas coastline (Figure 3-84: *AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the Edinburg East Freddy Gonzalez Drive Monitor on July 26, 2023*). The aerosol optical depth map (Figure 3-85: *AirNow Tech Aerosol Optical Depth (AOD) Map, with MODIS Terra and Aqua Satellite Layers on July 26, 2023*) shows high readings of aerosols in the Gulf, with Moderate AQI in South and Central Texas.

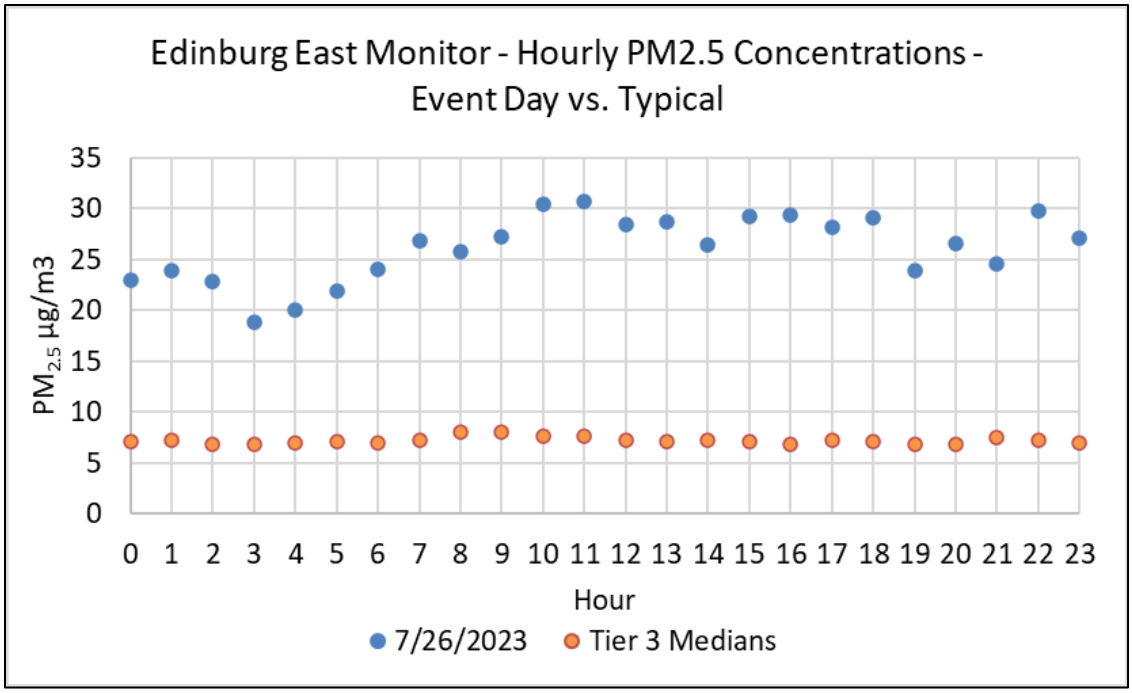

Figure 3-83: Hourly $PM_{2.5}$ Concentrations on July 26, 2023, Compared to Typical Concentrations at the Edinburg East Freddy Gonzalez Drive Monitor

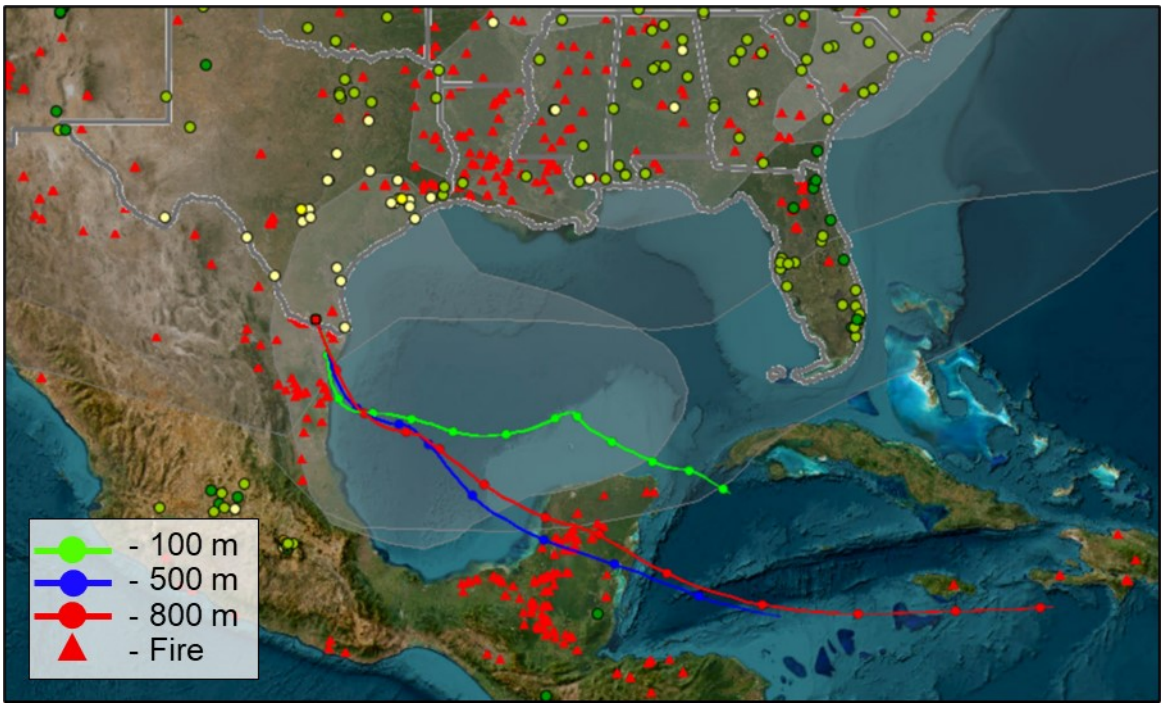

Figure 3-84: AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the Edinburg East Freddy Gonzalez Drive Monitor on July 26, 2023

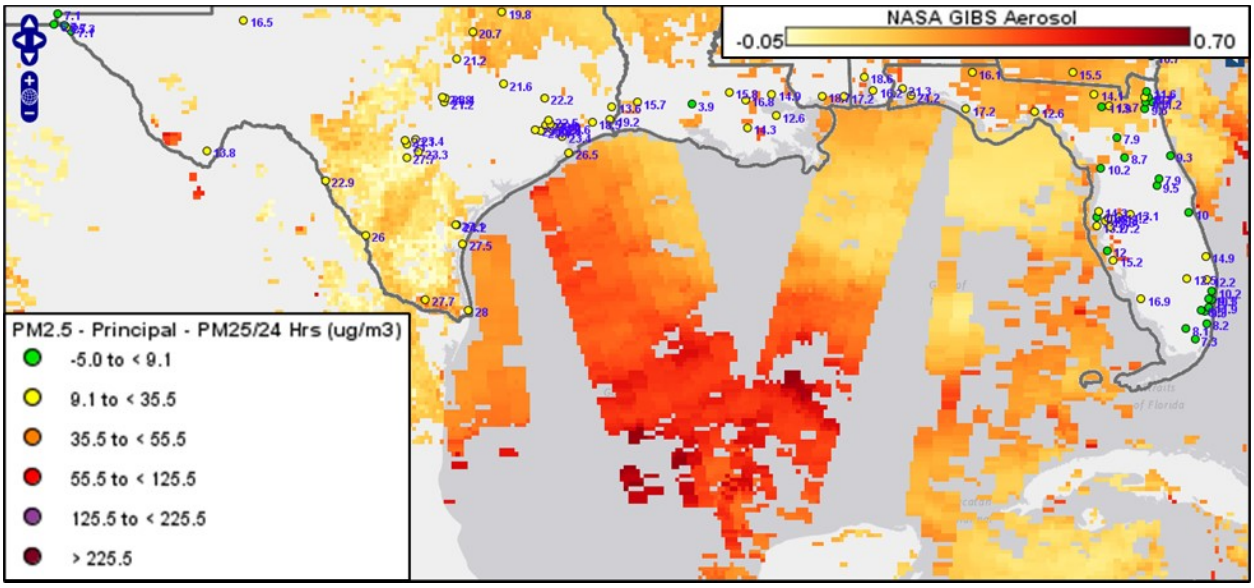

Figure 3-85: AirNow Tech Aerosol Optical Depth (AOD) Map, with MODIS Terra and Aqua Satellite Layers on July 26, 2023

For July 27, elevated concentrations of $PM_{2.5}$ can be compared against Tier 3 median values in Figure 3-86: *Hourly $PM_{2.5}$ Concentrations on July 27, 2023, Compared to Typical Concentrations at the Edinburg East Freddy Gonzalez Drive Monitor*. The TCEQ forecast mentions Saharan dust continuing to move over the entire state with varying intensities (Table C-11), and a local media report from Houston described the origins of Saharan dust (Figure C-14). Back trajectories (Figure 3-87: *AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the Edinburg East Freddy Gonzalez Drive Monitor on July 27, 2023*) show movement of air from the Gulf into the State of Texas. The aerosol optical depth map (Figure 3-88: *AirNow Tech Aerosol Optical Depth (AOD) Map, with MODIS Terra and Aqua Satellite Layers on July 27, 2023*) shows high values of aerosols in the Gulf, with Moderate AQI in South and Central Texas. The dust can be seen on visible satellite imagery being transported off the coast of Africa and toward the U.S. a few weeks before this EE grouping (Figure 3-89: *Aqua/MODIS Corrected Reflectance (True Color) Satellite Imagery from July 14, 2023, Showing Dust Being Transported off the Western Coast of Africa*). Forward trajectories from Africa (Figure 3-90: *NOAA HYSPLIT Forward Trajectories Originating from Western Africa, Starting on July 10, July 11, July 12, and July 13, 2023*) show that air parcels travelled over the Atlantic Ocean over North America.

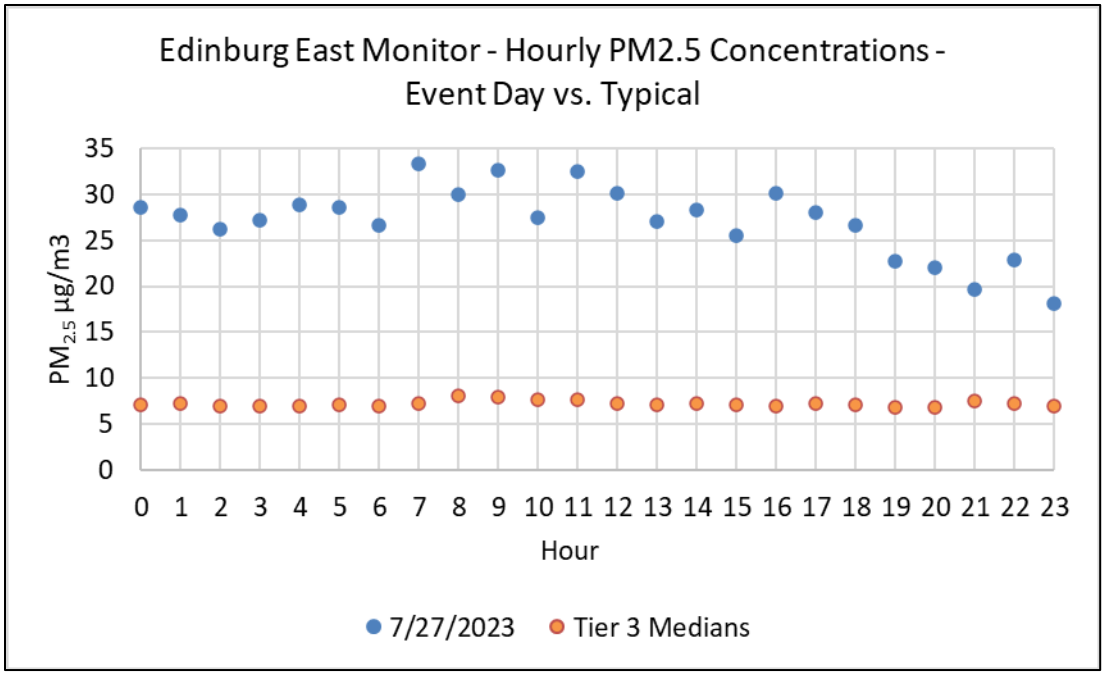

Figure 3-86: Hourly $PM_{2.5}$ Concentrations on July 27, 2023, Compared to Typical Concentrations at the Edinburg East Freddy Gonzalez Drive Monitor

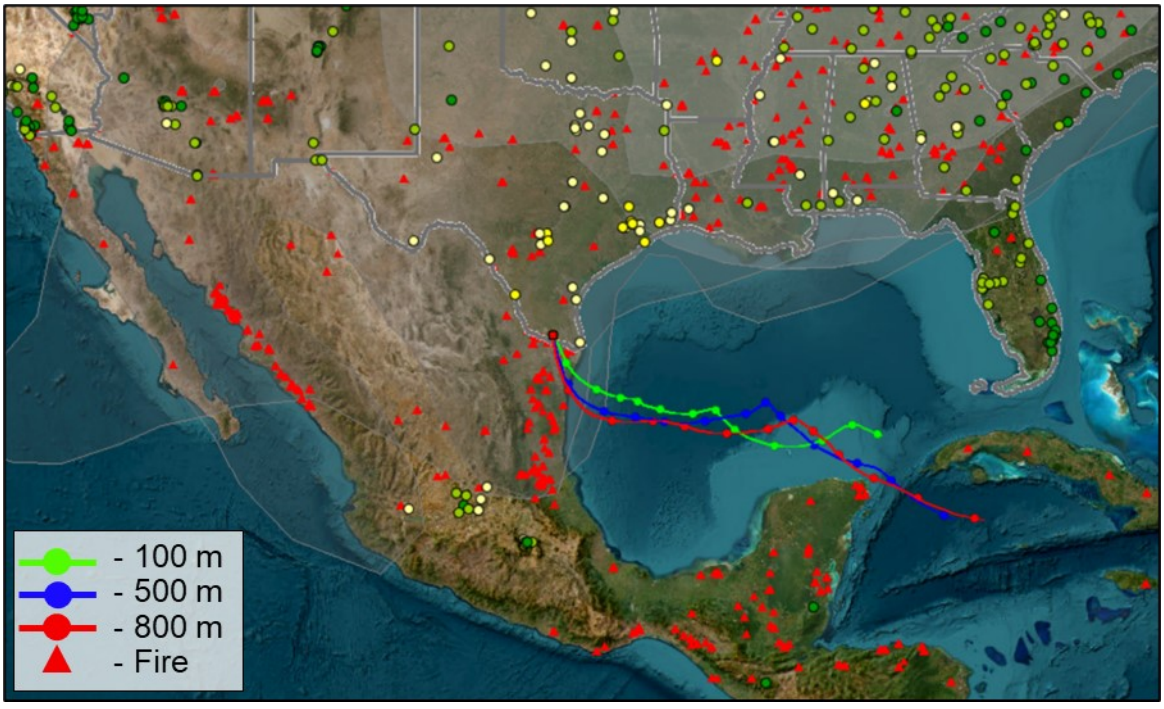

Figure 3-87: AirNow Tech HYSPLIT 72-Hour Back Trajectories Originating from the Edinburg East Freddy Gonzalez Drive Monitor on July 27, 2023

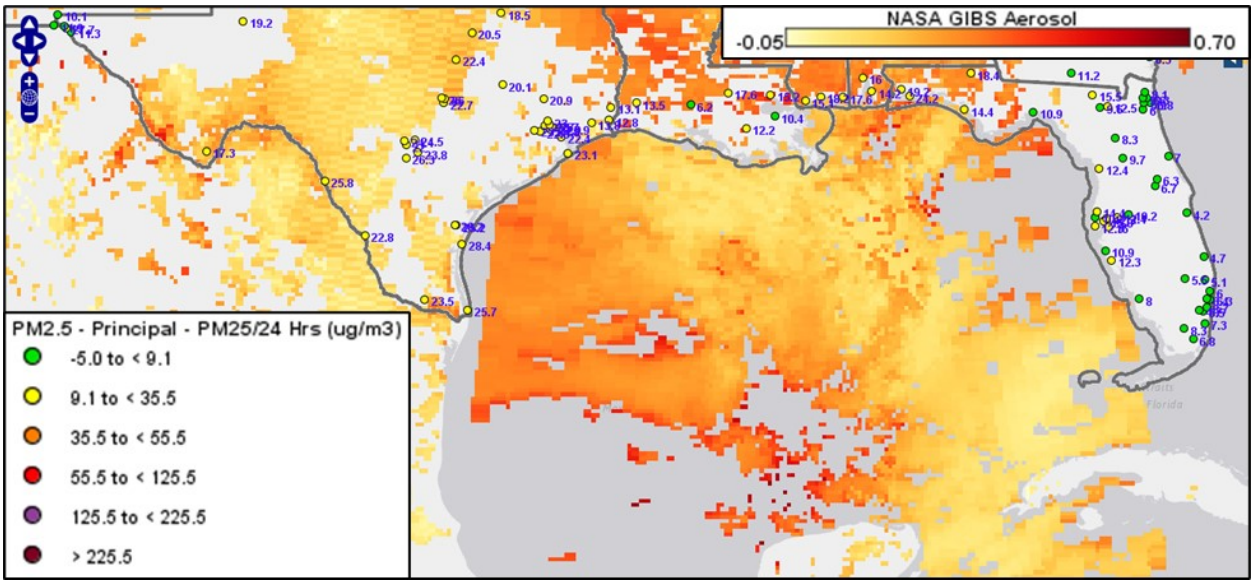

Figure 3-88: AirNow Tech Aerosol Optical Depth (AOD) Map, with MODIS Terra and Aqua Satellite Layers on July 27, 2023

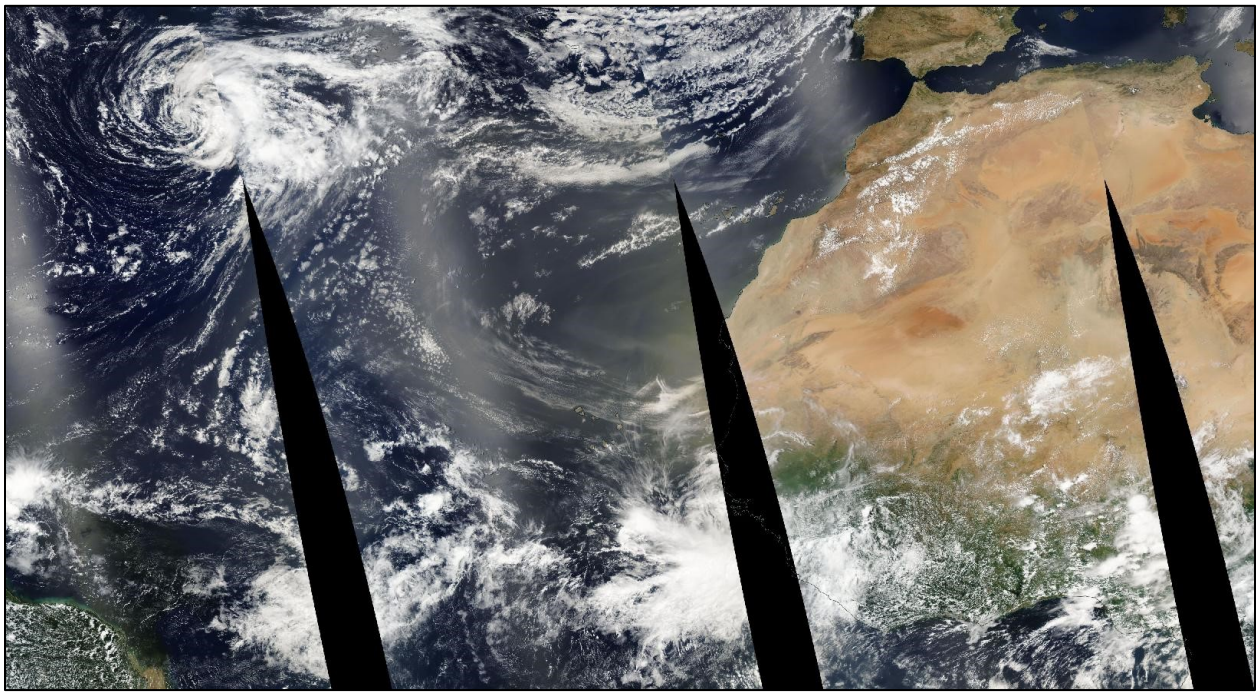

Figure 3-89: Aqua/MODIS Corrected Reflectance (True Color) Satellite Imagery from July 14, 2023, Showing Dust Being Transported off the Western Coast of Africa

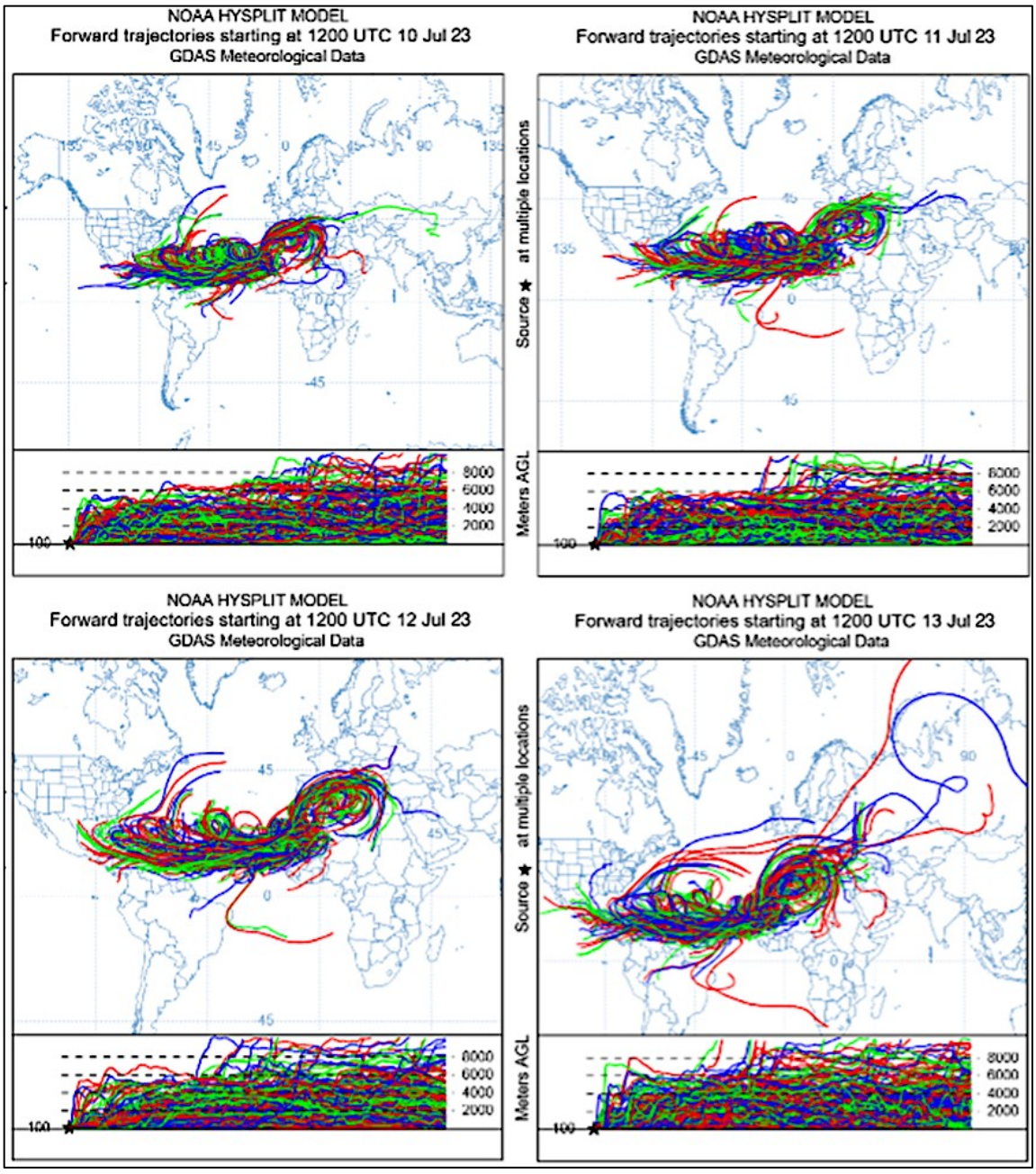

Figure 3-90: NOAA HYSPLIT Forward Trajectories Originating from Western Africa, Starting on July 10, July 11, July 12, and July 13, 2023

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.[11]

The wind rose at each monitor is from the EPA *$PM_{2.5}$ Designations Mapping Tool.*[12] 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.[13]

4.2.1 Atascosa County

The Von Ormy Highway 16 monitor is located in Atascosa County, in the city of Von Ormy, Texas. The major point sources of $PM_{2.5}$ (as defined in 40 CFR §§51.165 and 51.166) are located in south Atascosa County, while other major point sources can be seen north of Atascosa County, in southern Bexar County (Figure 4-1: *Point Sources in and around Atascosa County, from 2023*); however, a majority of the $PM_{2.5}$ emissions within Atascosa County are non-point, as shown in Table 4-1: *Emissions Inventory in Atascosa County, from 2020*.

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

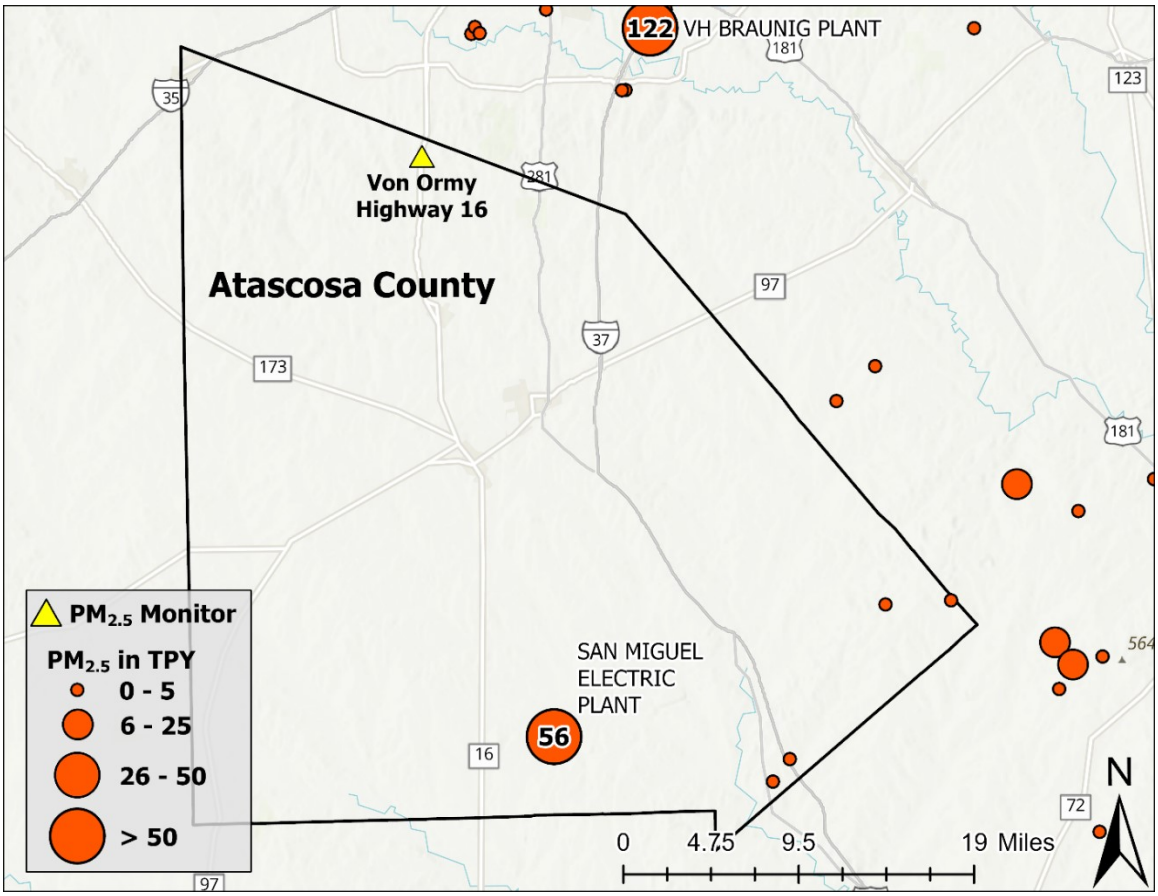

Figure 4-1: Point Sources in and around Atascosa County, from 2023

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

Emissions Categories	Emissions (tons per year)
On-road	23.10
Nonroad	8.22
Nonpoint	1,212.63
Point	88.05
Total	1,332.10

Figure 4-2: *Wind Roses in Bexar County, North of Atascosa County, from 2021-2023* shows that in monitors located in Bexar County, directly north of Atascosa County, a higher percentage of winds is coming from the south/southeast direction. Figure 4-3: *Hourly Average Continuous $PM_{2.5}$ Concentration at Von Ormy Highway 16 Monitor by Peak Area Hourly Wind Speed in Atascosa County for 2022-2024* displays hourly wind speeds at the Von Ormy Highway 16 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 $PM_{2.5}$ 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.

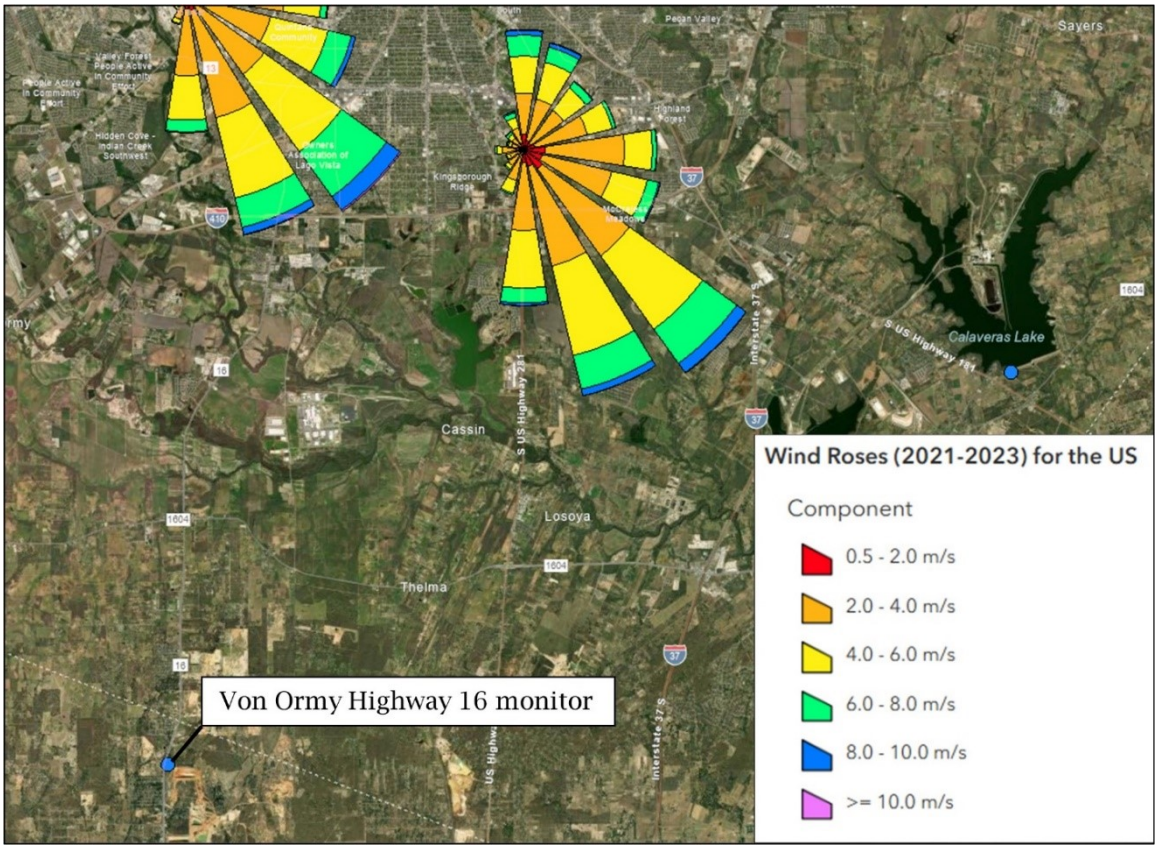

Figure 4-2: Wind Roses in Bexar County, North of Atascosa County, from 2021-2023

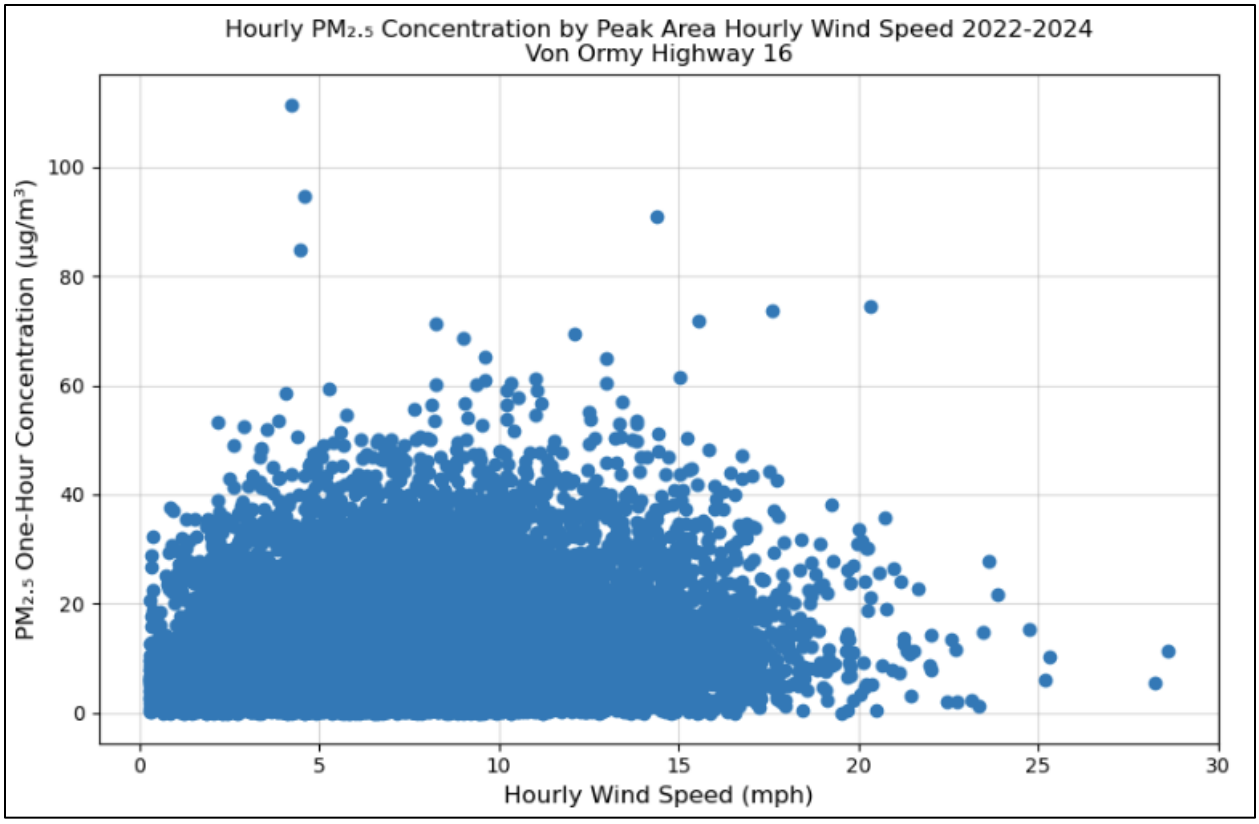

Figure 4-3: Hourly Average Continuous $PM_{2.5}$ Concentration at Von Ormy Highway 16 Monitor by Peak Area Hourly Wind Speed in Atascosa County for 2022-2024

4.2.2 Hidalgo County

The Edinburg East Freddy Gonzalez Drive monitor is located in Edinburg, Texas within Hidalgo County. The highest sources of $PM_{2.5}$ emissions within Hidalgo County (less than 50 tons per year) are approximately in the south-central and southern portions of Hidalgo County (Figure 4-4: *Point Sources in and around Hidalgo County, from 2023*); however, a majority of the $PM_{2.5}$ emissions are non-point, as shown in Table 4-2: *Emissions Inventory in Hidalgo County, from 2020*.

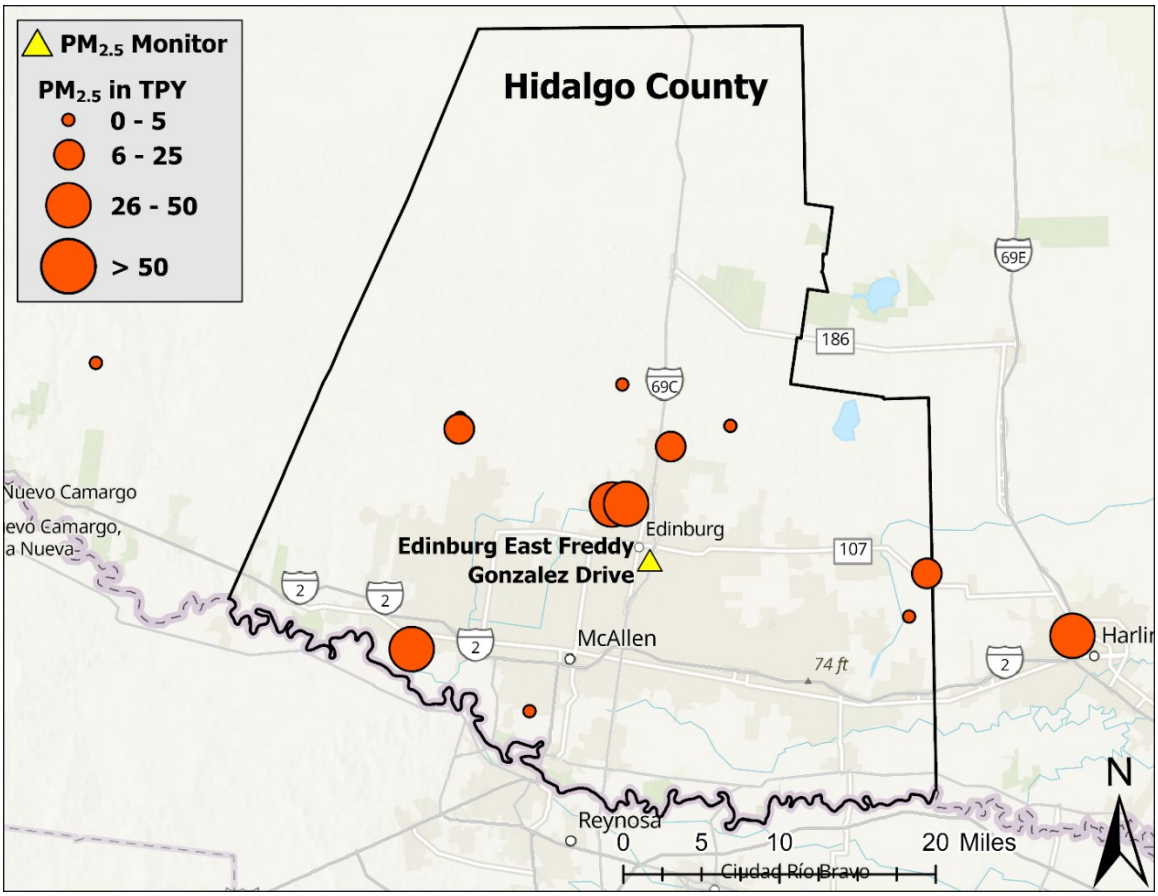

Figure 4-4: Point Sources in and around Hidalgo County, from 2023

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

Emissions Categories	Emissions (tons per year)
On-road	125.52
Nonroad	84.51
Nonpoint	5,019.03
Point	235.45
Total	5,464.51

Figure 4-5: *Wind Roses in Hidalgo County, from 2021-2023* shows that at Edinburg East Freddy Gonzalez Drive and other Hidalgo County monitors, a higher percentage of winds is coming from the south and east directions. Figure 4-6: *Hourly Average Continuous $PM_{2.5}$ Concentrations at the East Freddy Gonzalez Drive Monitor by Peak Area Hourly Wind Speed in Hidalgo County for 2022-2024* displays peak area hourly wind speeds at Hidalgo County monitors plotted against $PM_{2.5}$ concentrations at the Edinburg East Freddy Gonzalez Drive monitor. The pattern in Figure 4-6 shows that the highest $PM_{2.5}$ concentrations were recorded when hourly wind speeds were relatively low, or between five and 15 miles per hour.

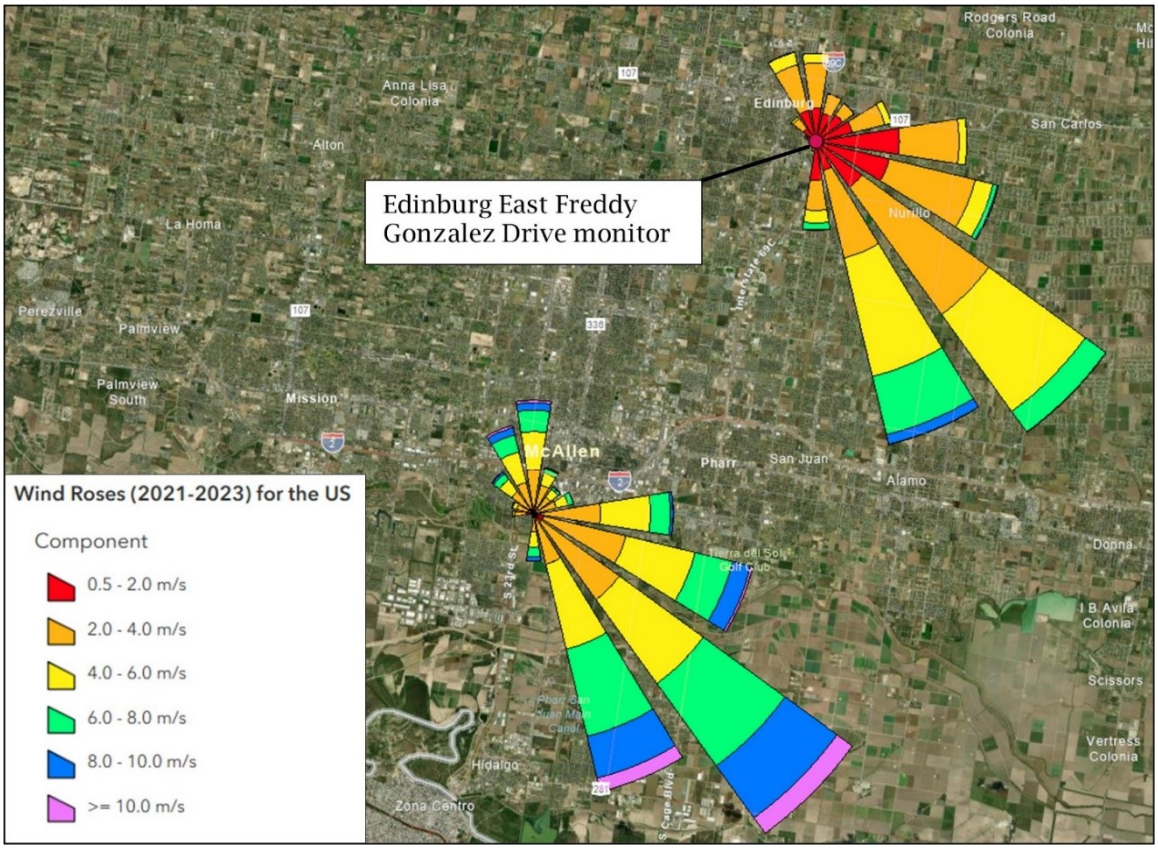

Figure 4-5: Wind Roses in Hidalgo County, from 2021-2023

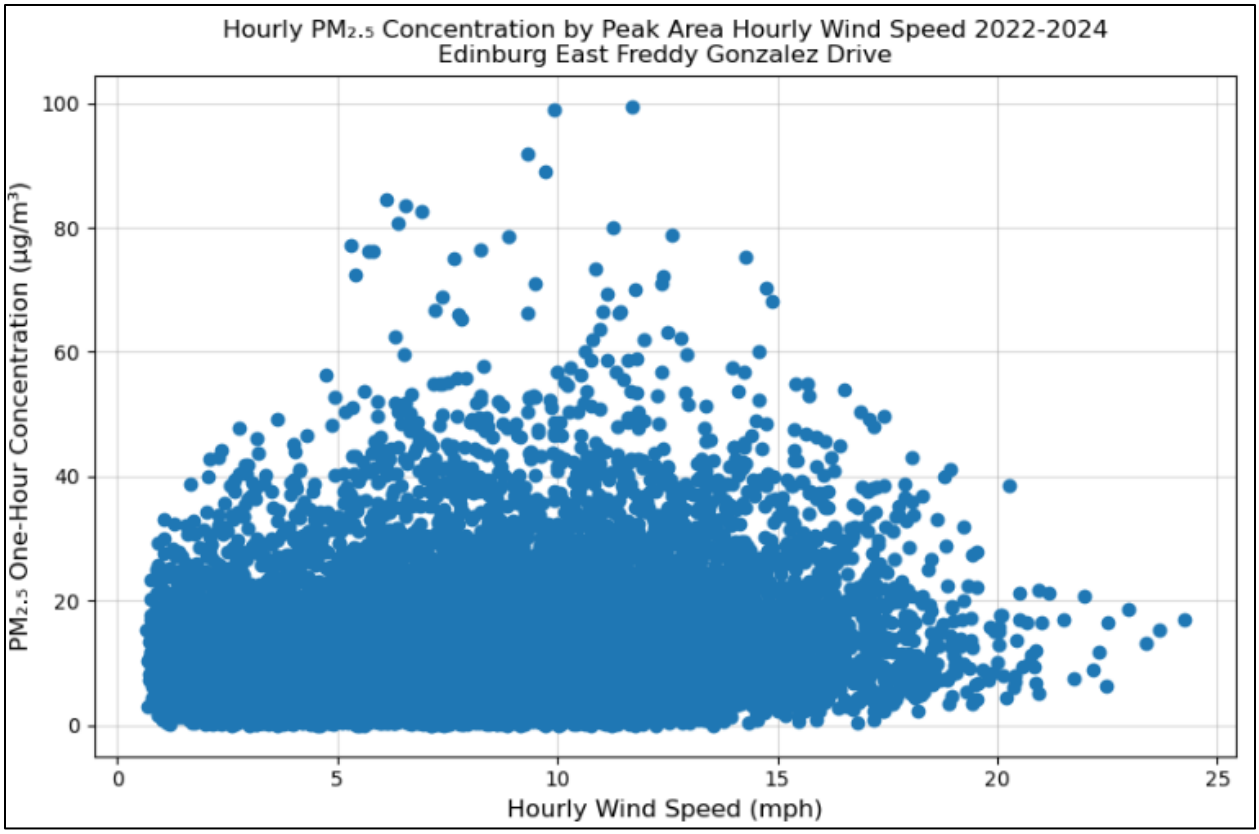

Figure 4-6: Hourly Average Continuous $PM_{2.5}$ Concentrations at the East Freddy Gonzalez Drive Monitor by Peak Area Hourly Wind Speed in Hidalgo County for 2022-2024

4.2.3 Tarrant County

The Fort Worth Northwest and Haws Athletic Center monitors are located in Fort Worth, Texas within Tarrant County. The major sources of $PM_{2.5}$ emissions are located approximately in the central portion of the county, while other major point sources can be seen southeast adjacent, in Ellis County (Figure 4-7: *Point Sources in and around Tarrant County, from 2023*); however, a significant portion of the $PM_{2.5}$ emissions is non-point, as shown in Table 4-3: *Emissions Inventory in Tarrant County, from 2020*.

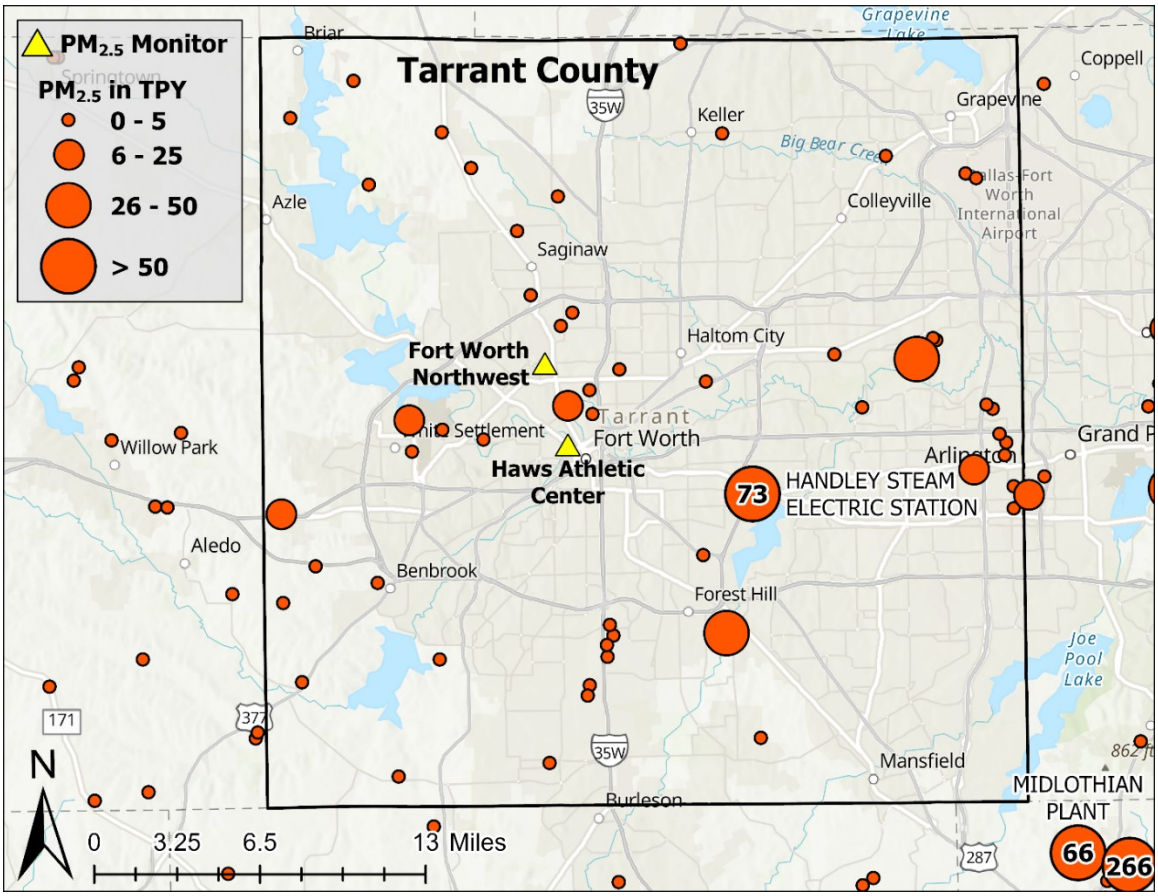

Figure 4-7: Point Sources in and around Tarrant County, from 2023

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

Emissions Categories	Emissions (tons per year)
On-road	319.06
Nonroad	301.17
Nonpoint	2,875.00
Point	243.57
Total	3,738.80

Figure 4-8: *Wind Roses in Tarrant County, from 2021-2023* shows that at Fort Worth Northwest and other Tarrant County monitors, a higher percentage of winds is coming from the south/southeast direction. Figure 4-9: *Hourly Average Continuous $PM_{2.5}$ Concentrations at the Fort Worth Northwest Monitor by Peak Area Hourly Wind Speed in Tarrant County for 2022-2024* and Figure 4-10: *Hourly Average Continuous $PM_{2.5}$ Concentrations at the Haws Athletic Center Monitor by Peak Area Hourly Wind Speed in Tarrant County for 2022-2024* displays peak area hourly wind speeds at Tarrant County monitors plotted against $PM_{2.5}$ concentrations at the Fort Worth Northwest and Haws Athletic Center monitors, respectively. There is no definitive pattern in Figure 4-9, while Figure 4-10 displays higher $PM_{2.5}$ concentrations when wind speeds were lower.

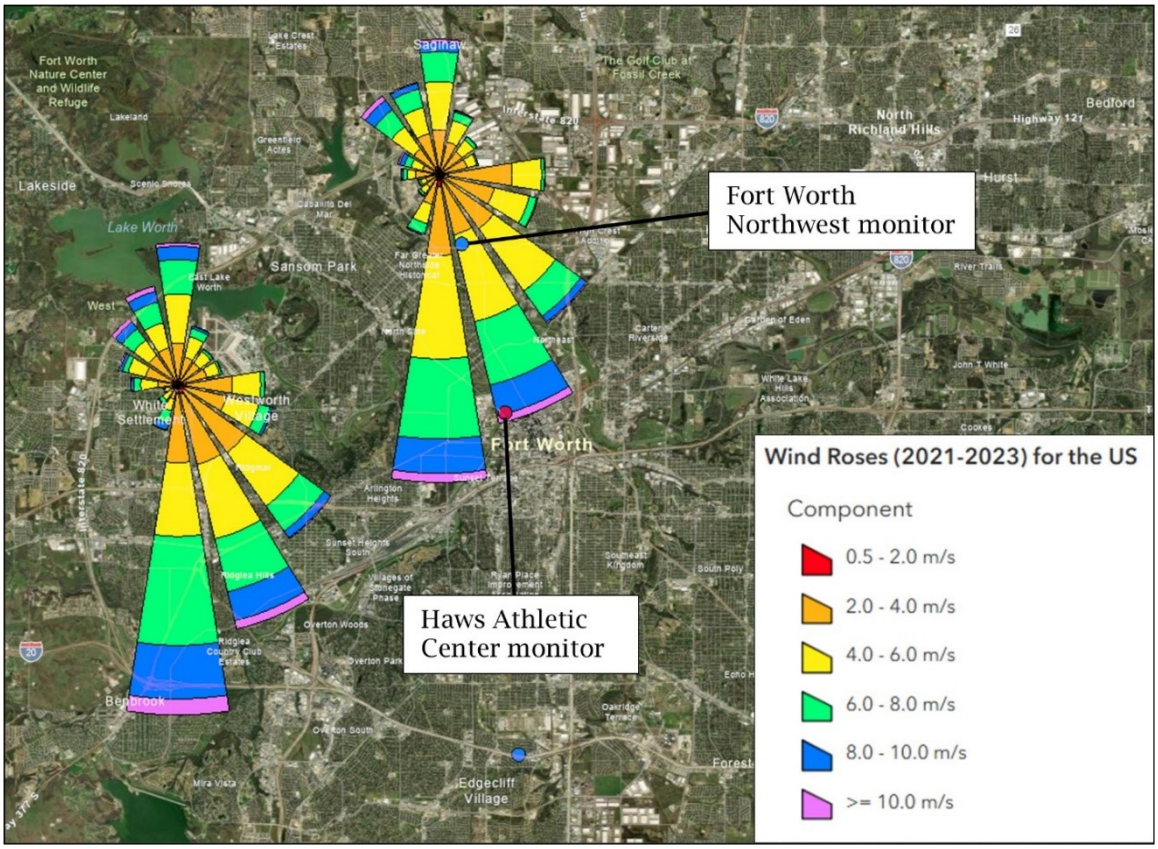

Figure 4-8: Wind Roses in Tarrant County, from 2021-2023

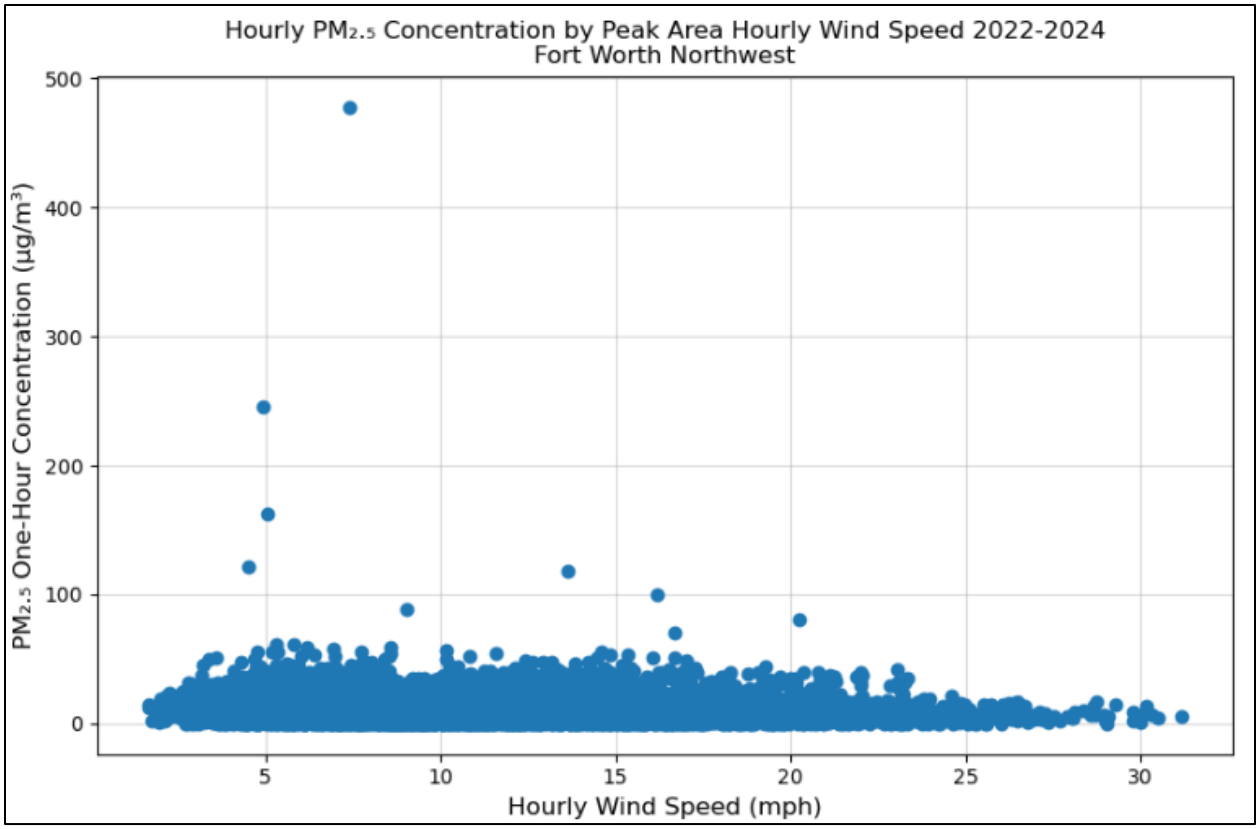

Figure 4-9: Hourly Average Continuous $PM_{2.5}$ Concentrations at the Fort Worth Northwest Monitor by Peak Area Hourly Wind Speed in Tarrant County for 2022-2024

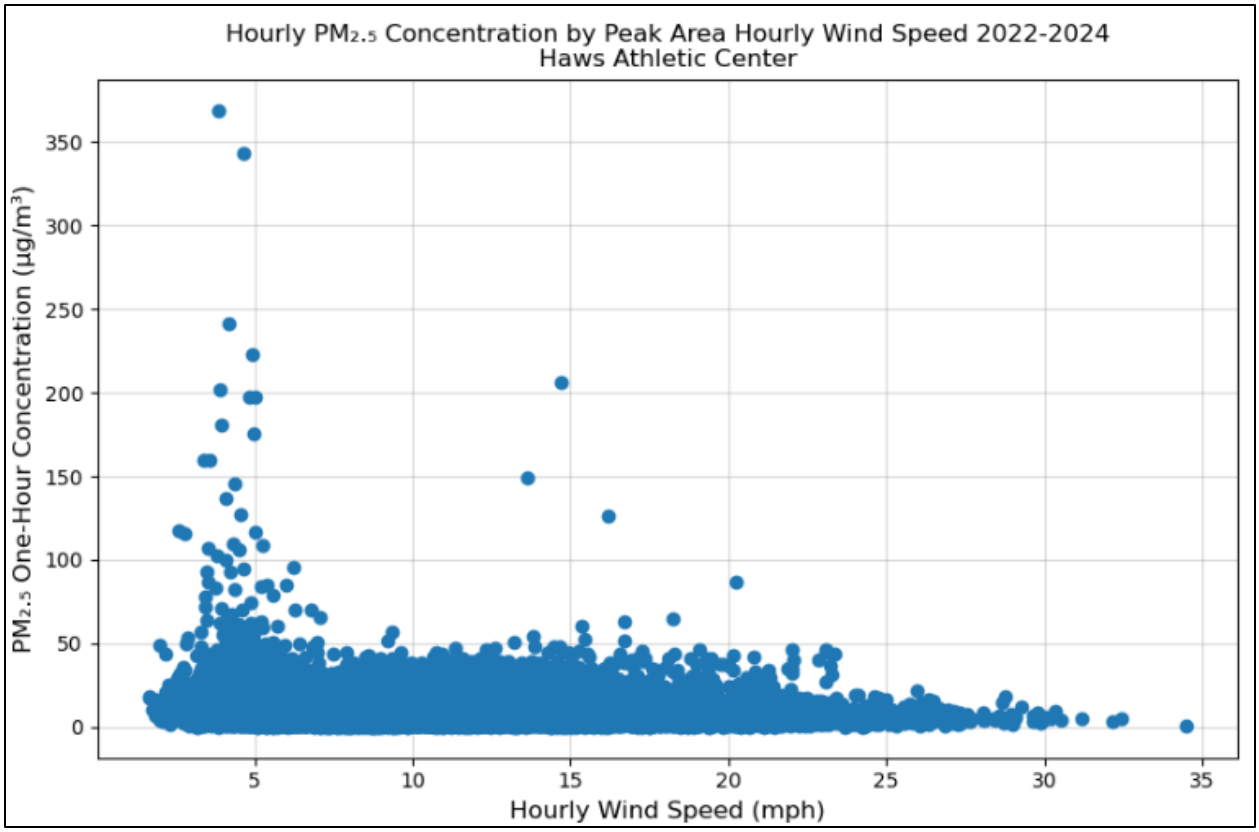

Figure 4-10: Hourly Average Continuous $PM_{2.5}$ Concentrations at the Haws Athletic Center Monitor by Peak Area Hourly Wind Speed in Tarrant County for 2022-2024

4.2.4 Webb County

The World Trade Bridge monitor is located in Laredo Texas, within Webb County. There are no major sources of $PM_{2.5}$ emissions in Webb County, as seen in Figure 4-11: *Point Sources in and around Webb County, from 2023*, and a significant portion of $PM_{2.5}$ emissions is non-point, as shown in Table 4-4: *Emissions Inventory in Webb County, from 2020*.

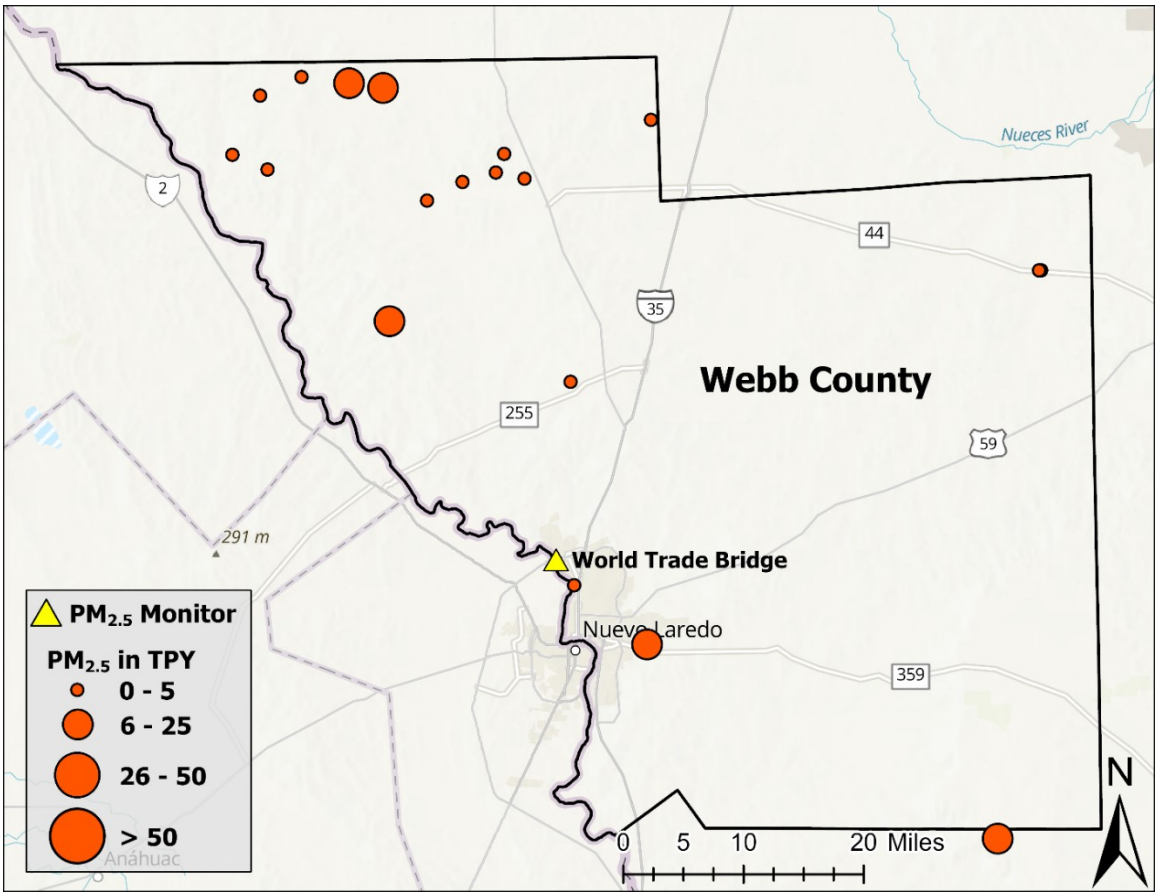

Figure 4-11: Point Sources in and around Webb County, from 2023

Table 4-4: Emissions Inventory in Webb County, from 2020

Emissions Categories	Emissions (tons per year)
On-road	70.92
Nonroad	60.04
Nonpoint	1,425.34
Point	59.34
Total	1,615.65

Figure 4-12: *Wind Rose in Webb County, from 2021-2023* shows that at Webb County monitors, a higher percentage of winds is coming from the south/southeast direction. Figure 4-13: *Hourly Average Continuous $PM_{2.5}$ Concentrations at the World Trade Bridge Monitor by Peak Area Hourly Wind Speed in Webb County for 2022-2024* displays peak area hourly wind speeds at Webb County monitors plotted against $PM_{2.5}$ concentrations at the World Trade Bridge monitor. There is no definitive pattern in Figure 4-13, though there are a few higher concentrations of $PM_{2.5}$ associated with slower wind speeds (less than 15 miles per hour).

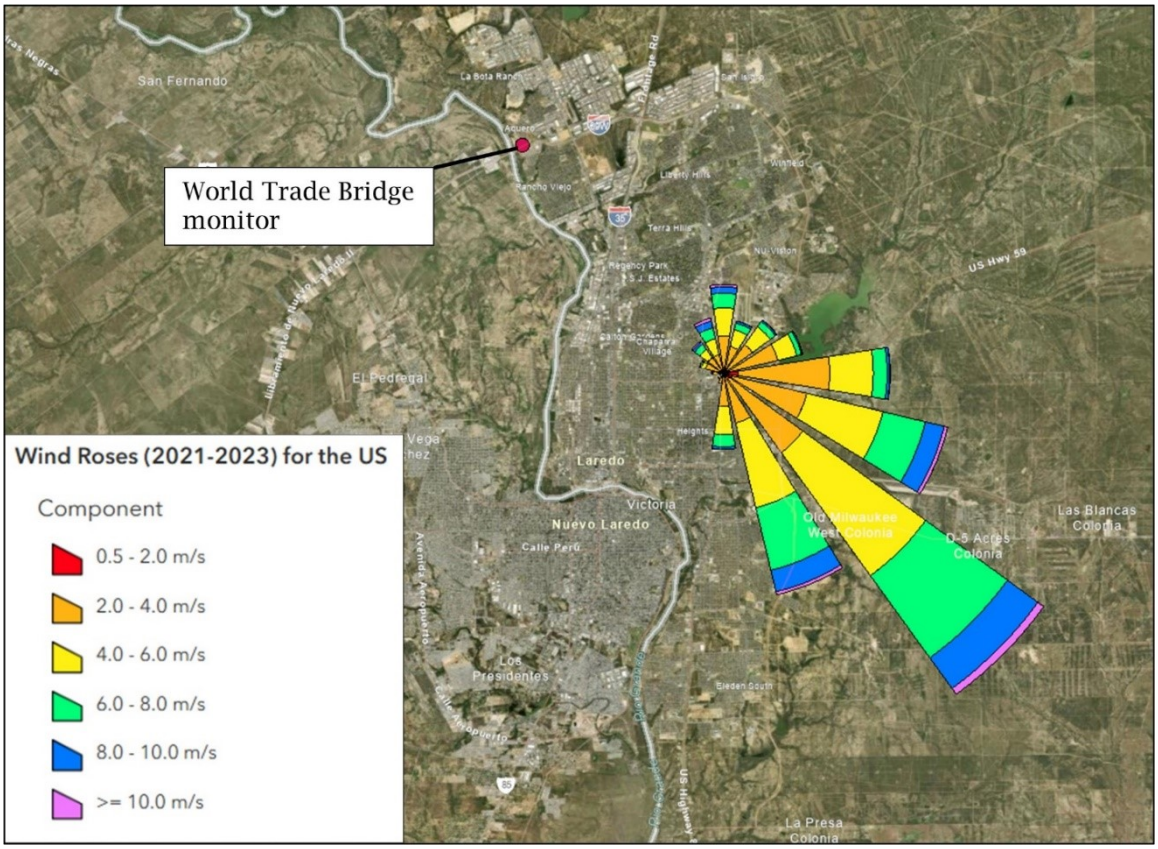

Figure 4-12: Wind Rose in Webb County, from 2021-2023

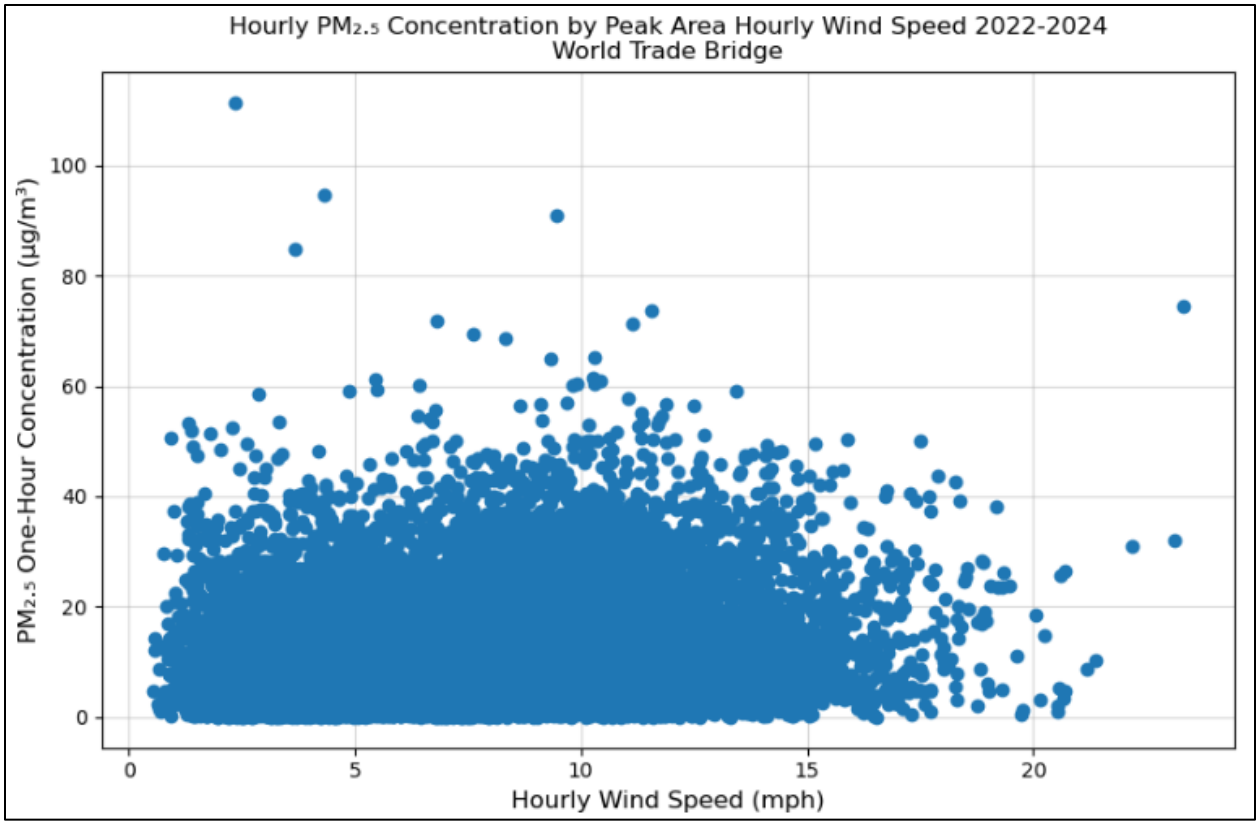

Figure 4-13: Hourly Average Continuous $PM_{2.5}$ Concentrations at the World Trade Bridge Monitor by Peak Area Hourly Wind Speed in Webb County for 2022-2024

4.3 ATTAINMENT STATUS AND CONTROL MEASURES

Atascosa, Hidalgo, Tarrant, and Webb 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.[14] 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.[15]

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

4.4 FIRES IN MEXICO/CENTRAL AMERICA AND AFRICAN 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.*

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. Figure 5-1: *July 2023 Monthly Average Dust Surface Mass Concentration (MERRA-2)* shows the dust surface mass concentration layer created from a time-averaged 2-dimensional mean data collection from July 2023, obtained from NASA Worldview. The dust layer concentrations are higher along the transport route from Africa through the Caribbean and into Texas.

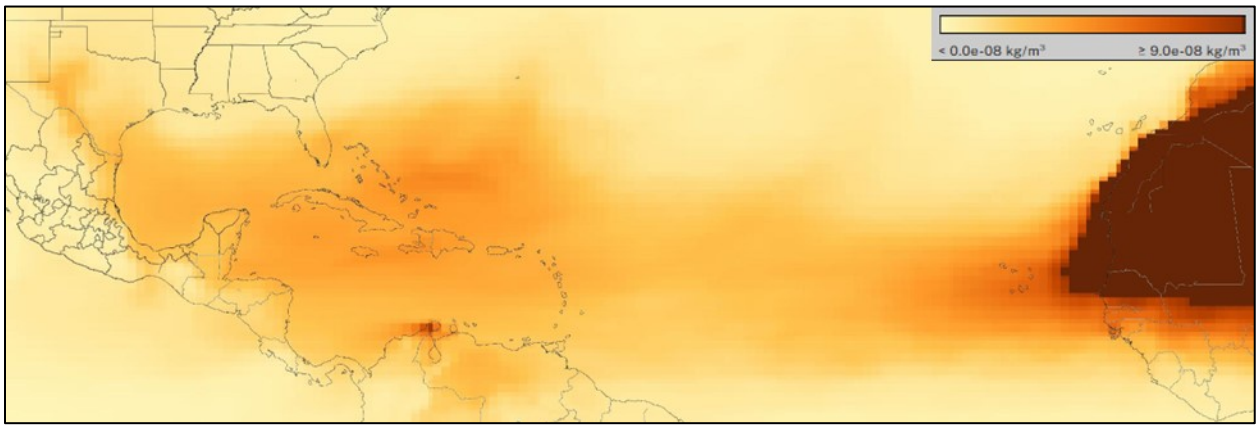

Figure 5-1: July 2023 Monthly Average Dust Surface Mass Concentration (MERRA-2)

The transport of dust can also be seen in speciation data at several monitoring sites in Texas. Iron, aluminum, and silicon are typical components of dust, and their presence indicates dust storms and long-range transport from natural sources (Chow, Judith C. et al., "Mass reconstruction methods for $PM_{2.5}$: a review", 2015)[16]. In Figure 5-2: *Concentration data of aluminum, iron, and silicon from three Texas monitoring sites in 2023*, there are two maximums of these speciated components in July 2023, corresponding to the two Saharan dust exceptional

[16] https://pmc.ncbi.nlm.nih.gov/articles/PMC4449935/

event groups during this month. The speciation data was obtained from the TCEQ TAMIS database. [17]

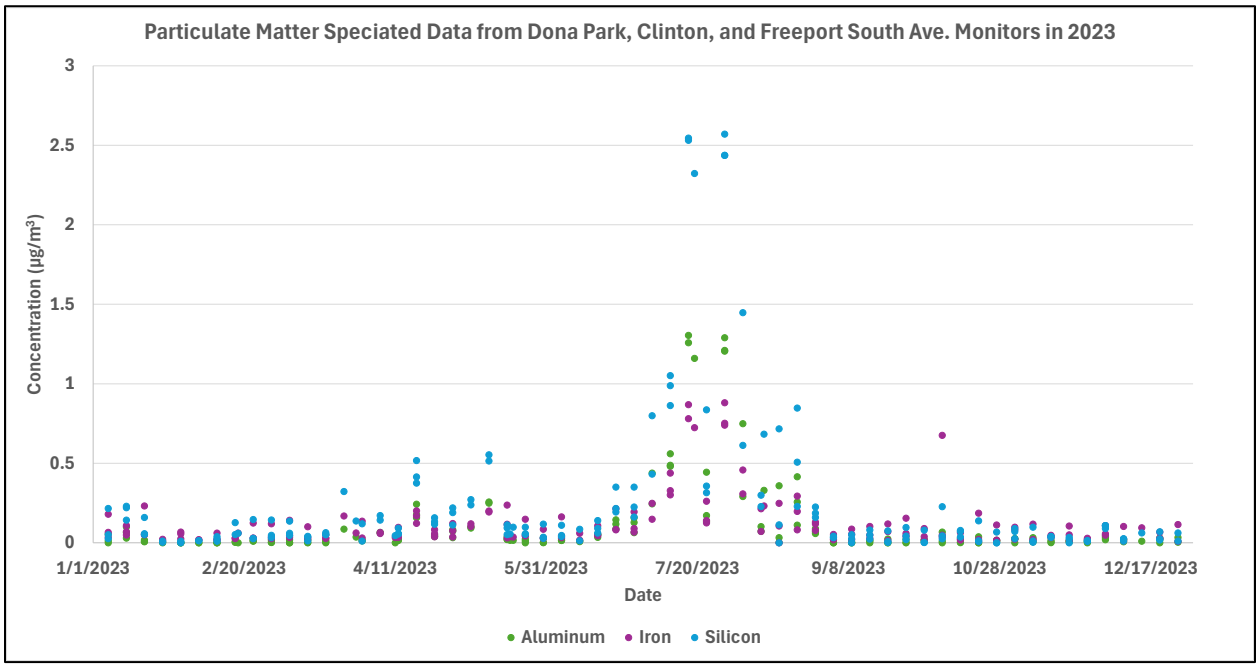

Figure 5-2: Concentration data of aluminum, iron, and silicon from three Texas monitoring sites in 2023

5.3 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.

5.4 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.[18] The evidence includes statistics on the source of fires from the Mexican government and other sources.

[17] https://www17.tceq.texas.gov/tamis/index.cfm
[18] https://www.tceq.texas.gov/downloads/air-quality/sip/pm/ramboll_mexicanfires.pdf

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 eastern 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 2023 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.[19] In 2023, a total of 7,611 instances of fires were reported with 14 unique possible causes: Campfires, 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, 2,334 (31%) fires occurred in protected natural areas and are unlikely to recur. Figure 5-3: *Map of Forest Fires in Mexico in 2023* is a map of all the instances of forest fires reported in 2023. Figure 5-4: *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.[20] 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 2023.

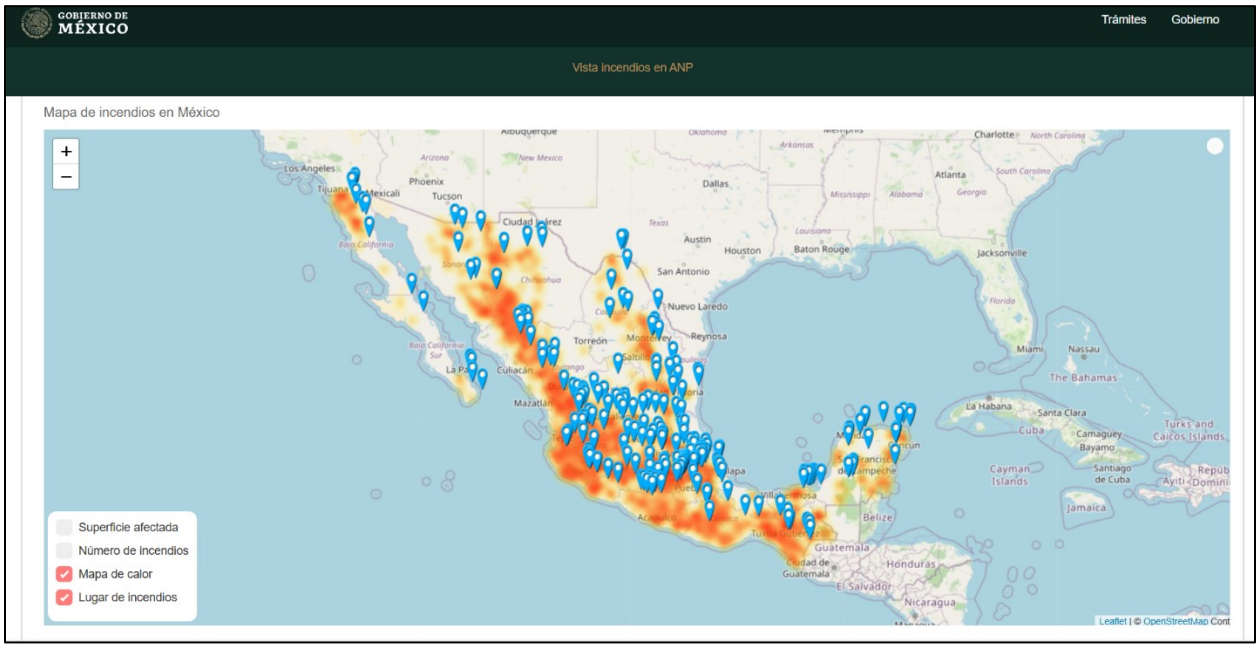

Figure 5-3: Map of Forest Fires in Mexico in 2023

[19] https://monitor_incendios.cnf.gob.mx/incendios_tarjeta_semanal, accessed on January 27, 2025.
[20] TCEQ classified forest fires that had possible causes of Campfires, Intentional, Smokers, Hunters, Natural, and Forest Waste as unlikely to recur.

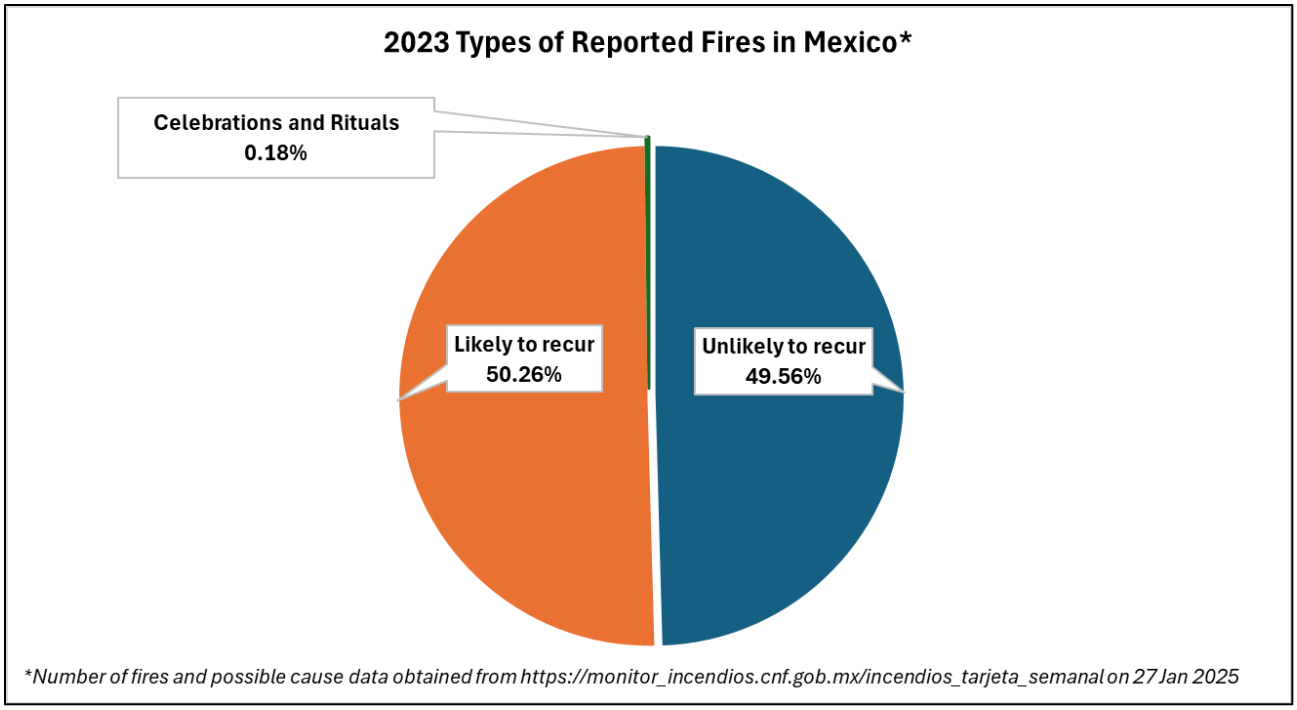

Figure 5-4: Fires in Mexico in 2023 classified as unlikely or likely to recur based on possible causes

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, $PM_{2.5}$, and particulate matter less than or equal to 10 microns in diameter (PM_{10}) 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.[21, 22]

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.[23] 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.[24]

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.[25] 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 of particulate matter.[26] The webpage also addresses the latest air quality planning for the particulate matter NAAQS.

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[21] http://www.tceq.texas.gov/airquality/monops/forecast_today.html
[22] http://airnow.gov
[23] https://www.tceq.texas.gov/cgi-bin/compliance/monops/select_curlev.pl?user_param=88101
[24] https://www.tceq.texas.gov/airquality/monops/data-reports
[25] http://www.tceq.texas.gov/airquality/monops/ozone_email.html
[26] https://www.tceq.texas.gov/airquality/sip/criteria-pollutants/sip-pm

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.[27]

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.[28]

The Texas Department of Transportation (TxDOT) sponsors the public education and awareness through the Drive Clean Across Texas campaign.[29] 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.[30]

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.[31]

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[27] http://www.tceq.texas.gov/agency/air_main.html
[28] https://www.airnow.gov
[29] http://www.drivecleanacrosstexas.org
[30] http://takecareoftexas.org/air-quality
[31] 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 Von Ormy Highway 16, Edinburg East Freddy Gonzalez Drive, Haws Athletic Center, Fort Worth Northwest, and World Trade Bridge monitors were impacted by smoke and dust from fires in Mexico and Central America, high winds, 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.