GEORGIA
DEPARTMENT OF NATURAL RESOURCES

ENVIRONMENTAL PROTECTION DIVISION

Holiday Fireworks Exceptional Event Demonstration for Exceedances of the 2024 Annual $PM_{2.5}$ NAAQS at Augusta, GA in 2021-2023

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1. Introduction

The current annual and 24-hour $PM_{2.5}$ National Ambient Air Quality Standards (NAAQS) are 9.0 µg/m^3 and 35 µg/m^3, respectively. Federal Reference Method (FRM) monitors collect $PM_{2.5}$ samples for 24 hours on filters while Federal Equivalent Method (FEM) monitors measure hourly $PM_{2.5}$ concentrations continuously. An exceedance of the 2024 annual $PM_{2.5}$ NAAQS occurs when the measured 24-hour $PM_{2.5}$ concentration is greater than 9.0 µg/m^3.

From 2019 through 2023, one FEM monitor collected data at the Augusta site (AQS ID: 13-245-0091). In addition, in 2022, two collocated FRMs began collecting data. The primary monitor operated on a one in three-day schedule from January 2022 to August 2022, and then on a daily schedule starting August 2022. The collocated FRM monitor collected data on a one in three-day schedule starting September 2022. In addition, the FEM had a NAAQS exclusion starting in January 2022. In 2023, the two collocated FRMs continued to collect data, with a daily schedule for the primary monitor and one in three-day schedule for the collocated monitor, and the FEM monitor continued to collect data with a NAAQS exclusion through 2023. The Augusta-Richmond County, GA-SC MSA is in attainment of the 2012 $PM_{2.5}$ NAAQS.

Exceedances of the 2024 annual $PM_{2.5}$ NAAQS occurred at the Augusta $PM_{2.5}$ monitor in 2021-2023 that qualify for removal under the Exceptional Events Rule (EER). On December 20, 2024, Georgia Environmental Protection Division (EPD) submitted an Initial Notification for these events to the U.S. Environmental Protection Agency (EPA). The request indicated that 24-hour $PM_{2.5}$ concentrations on the forty (40) days shown in Table 1 were impacted by smoke from Canadian wildfires (8 days), holiday fireworks (3 days), and prescribed fires (29 days). The request also included review of the events under the case-by-case provision at 40 CFR 50.14(a)(1)(i)(F). This demonstration will focus on the three holiday fireworks events, while separate demonstrations will focus on the eight Canadian wildfire events and 29 prescribed fire events. Table 2 shows the impact of exclusion of the data on the 2021-2023 design value (DV) for Augusta.

Table 1. Exceedances of the 2024 annual $PM_{2.5}$ NAAQS occurred at the Augusta $PM_{2.5}$ monitor (AQS ID: 13-245-0091) in 2021-2023 that qualify for removal under the EER.

#	Date	24-hour $PM_{2.5}$ (µg/m^3)	Tier	Cause of Exceedance
1	02/04/21	22.1	1	Prescribed fires
2	02/25/21	22.23	1	Prescribed fires
3	02/26/21	21.6	1	Prescribed fires
4	02/27/21	38.58	1	Prescribed fires
5	02/28/21	52.15	1	Prescribed fires
6	03/09/21	30.3	1	Prescribed fires
7	03/10/21	39.66	1	Prescribed fires
8	03/13/21	27.17	1	Prescribed fires
9	04/07/21	29.53	1	Prescribed fires
10	04/08/21	23.18	1	Prescribed fires
11	04/28/21	21.53	1	Prescribed fires
12	07/04/21	42.35	1	Holiday Fireworks

13	07/05/21	39.33	1	Holiday Fireworks
14	07/23/21	22.49	1	Prescribed fires
15	10/15/21	27.18	1	Prescribed fires
16	11/10/21	21.08	1	Prescribed fires
17	12/02/21	25.79	1	Prescribed fires
18	12/04/21	24.89	1	Prescribed fires
19	12/05/21	41.94	1	Prescribed fires
20	12/06/21	23.76	1	Prescribed fires
21	12/16/21	36.35	1	Prescribed fires
22	03/03/22	25.3	1	Prescribed fires
23	12/28/22	23.1	1	Prescribed fires
24	03/01/23	25.6	1	Prescribed fires
25	03/16/23	22.3	1	Prescribed fires
26	04/20/23	21	1	Prescribed fires
27	06/09/23	20.2	1	Canadian Wildfires
28	06/10/23	22.8	1	Canadian Wildfires
29	06/18/23	23.2	1	Canadian Wildfires
30	06/29/23	22.7	1	Canadian Wildfires
31	06/30/23	26.4	1	Canadian Wildfires
32	07/01/23	20.3	1	Canadian Wildfires
33	07/04/23	20.6	1	Holiday Fireworks
34	07/18/23	26.3	1	Canadian Wildfires
35	08/23/23	20.8	1	Canadian Wildfires
36	11/06/23	20.8	1	Prescribed fires
37	11/07/23	22.4	1	Prescribed fires
38	11/09/23	20.8	1	Prescribed fires
39	12/07/23	31.1	1	Prescribed fires
40	12/08/23	31.4	1	Prescribed fires

Table 2. Augusta 2021-2023 DVs for the 2024 annual $PM_{2.5}$ NAAQS.

Monitoring Site (AQS ID)	**2021-2023 DV without EPA Concurrence (µg/m^3)**	**2021-2023 DV with EPA Concurrence (µg/m^3)**
Augusta (13-245-0091)	9.7	9.0

EPA outlines the treatment of air quality monitoring data influenced by fireworks displays in 40 CFR 50.14(b)(2) stating, *"The Administrator shall exclude data from use in determinations of exceedances and violations where a State demonstrates to the Administrator's satisfaction that emissions from fireworks displays caused a specific air pollution concentration in excess of one or more national ambient air quality standards at a particular air quality monitoring location and otherwise satisfies the requirements of this section. Such data will be treated in the same manner as exceptional events under this rule, provided a State demonstrates that such use of fireworks is significantly integral to traditional national, ethnic, or other cultural events*

including, but not limited to, July Fourth celebrations that satisfy the requirements of this section."

The demonstration to justify data exclusion, as outlined in 40 CFR 50.14, specifies that the following evidence must be provided:

1. A narrative conceptual model that describes the event;
2. There is a clear causal relationship between the measurements under consideration and the event that is claimed to have affected air quality in the area;
3. Analyses comparing the claimed event influenced concentrations to concentrations at the same monitoring site at other times;
4. A state must take appropriate and reasonable actions to protect public health from exceedances or violations of the national ambient air quality standards by developing and implementing a mitigation plan for recurring events and;
5. The event documentation must be made available for a 30-day public comment period.

This demonstration will describe how the proposed firework events meet the requirements of the EER as described in regulation and the guidance documents, as applicable.

2. Narrative Conceptual Model

This section addresses the EER requirement at 40 CFR 50.14(c)(3)(iv)(A), which requires a narrative conceptual model that describes the event causing the exceedance and a discussion of how emissions from the event led to the exceedance at the affected monitor. In addition, this section includes a summary of how mitigation requirements in 40 CFR 51.930(a) were addressed.

July Fourth is a federal holiday that is a significantly integral national celebration traditionally celebrated with evening fireworks in the United States. Fireworks generate transient episodes of high concentrations of $PM_{2.5}$ and gaseous air pollutants. Elevated $PM_{2.5}$ levels were noted on the evening of July 4, 2021 (42.35 $\mu g/m^3$) and July 5, 2021 (39.33 $\mu g/m^3$) at the Augusta $PM_{2.5}$ monitoring station, which resulted in exceedances of the annual and 24-hour $PM_{2.5}$ NAAQS. Also, elevated $PM_{2.5}$ levels were noted on the evening of July 4, 2023 (20.6 $\mu g/m^3$) at the Augusta air monitoring station, which resulted in exceedances of the annual $PM_{2.5}$ NAAQS.

For the three holiday fireworks exceedance days listed in Table 1, National Oceanic and Atmospheric Administration (NOAA) Hazard Mapping System (HMS) smoke plumes and fire data, Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) trajectory modeling, and location of fireworks are used to clearly demonstrate that smoke from the fireworks conducted on the day of the exceedance and/or the day before the exceedances were transported to the Augusta monitor causing the exceedances. Section 3 of this document contains details to support this conceptual model.

As described in 40 CFR 51.930(a), states requesting to exclude data due to exceptional events must take appropriate and reasonable actions to protect public health from exceedances or violations of the NAAQS. These include providing for, at a minimum, prompt public notification whenever concentrations are expected to exceed a NAAQS, public education on actions individuals may take to reduce exposures to unhealthy air quality during events, and

implementation of appropriate measures to protect public health from event-caused exceedances or violations of the NAAQS.

With respect to public notification and public education, the Georgia Forestry Commission (GFC) has a public website[1] with an interactive wildfire and burn permit map that contains the current Air Quality Index at all monitors in Georgia with the option to add the following layers: (1) burn restrictions, (2) daily burn permits, (3) $PM_{2.5}$, (4) NOAA HMS smoke plumes, (5) wind vectors, and (6) smoke forecast. The public can zoom in to see if smoke may impact their location. The Georgia EPD website[2] has a link to the GFC interactive burn permit map. Also, the Georgia EPD website has a link to EPA's AirNow Fire and Smoke Map[3], EPA's AirNow When Smoke is in the Air[4], EPA's AirNow Prepare for Fire Season[5], and the EPA's Smoke-Ready Toolbox for Wildfires[6]. These websites identify several protective measures that individuals should take to reduce smoke exposure as needed, including limiting outdoor activities, avoiding strenuous outdoor activity and remaining indoors, and considering temporarily relocating or closing all doors and windows during smoke events. In addition, the Georgia EPD Ambient Air Monitoring Program website[7] provides near real-time ambient air concentrations of multiple criteria pollutants (O_3, $PM_{2.5}$, SO_2, NO_2, and CO) across the state.

This demonstration requests concurrence that the three exceedances of the 2024 annual $PM_{2.5}$ NAAQS measured at the Augusta site caused by holiday fireworks on the dates listed in Table 1 be excluded from regulatory decision making.

3. Clear Causal Relationship

This section addresses the EER requirements at 40 CFR 50.14(c)(3)(iv)(B) by showing 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, and at 40 CFR 50.14(c)(3)(iv)(C) by providing analyses comparing the claimed event-influenced concentrations to concentrations at the same monitoring site at other times. The expected components of a clear causal relationship include a comparison of the event-related concentration to historical concentrations, evidence that the emissions from the fireworks were transported to the monitor, and evidence that the fireworks emissions affected the monitor.

The historical data analysis section of this demonstration will focus on 2019-2023 $PM_{2.5}$ FEM data from the Augusta monitor. Table 3 contains a comparison of fireworks exceptional event concentrations to historic 2019-2023 concentrations at the Augusta $PM_{2.5}$ monitor (AQS ID: 13-245-0091). Generally, the exceptional event concentrations are two times higher than the 5-year annual average, quarterly average, and monthly average, and up to 4.4 times higher.

[1] https://georgiafc.firesponse.com/public/
[2] https://epd.georgia.gov/air-protection-branch/open-burning-rules-georgia
[3] https://fire.airnow.gov/
[4] https://www.airnow.gov/wildfires/when-smoke-is-in-the-air/
[5] https://www.airnow.gov/sites/default/files/2020-10/prepare-for-fire-season.pdf
[6] https://www.epa.gov/air-research/smoke-ready-toolbox-wildfires
[7] https://airgeorgia.org/

Table 3. Comparison of exceptional event concentrations to historic 2019-2023 concentrations at the Augusta $PM_{2.5}$ monitor (AQS ID: 13-245-0091).

Exceptional Event Date	Exceptional Event (EE) Concentration ($\mu g/m^3$)	5-Year Annual Average ($\mu g/m^3$)	5-Year Quarterly Average ($\mu g/m^3$)	5-Year Monthly Average ($\mu g/m^3$)	Ratio EE to 5-Year Annual Average	Ratio EE to 5-Year Quarterly Average	Ratio EE to 5-Year Monthly Average
07/04/21	42.35	9.6	9.53	10.18	4.4	4.4	4.2
07/05/21	39.33	9.6	9.53	10.18	4.1	4.1	3.9
07/04/23	20.6	9.6	9.53	10.18	2.1	2.2	2.0

Figure 1 plots the 24-hour $PM_{2.5}$ concentrations for 2019-2023. The concentrations are generally below the Tier 3 value of 13.19 $\mu g/m^3$, except when smoke from fireworks, wildfires, and prescribed burns is present. All the selected exceptional events days are above the Tier 1 threshold of 19.79 $\mu g/m^3$.

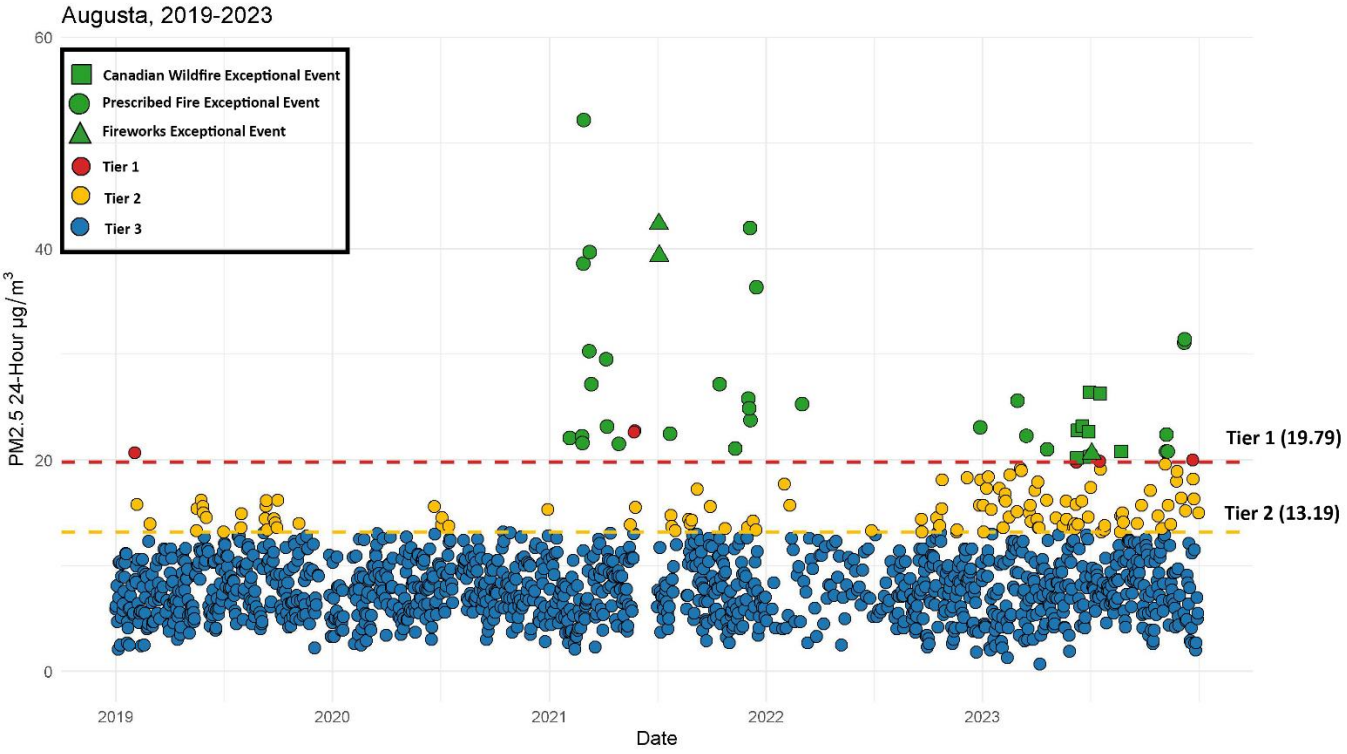

Figure 1. 24-hour $PM_{2.5}$ concentrations for 2019-2023 at the Augusta monitor. Wildfire exceptional events are shown in green circles squares, prescribed fire exceptional events are shown in green circles, and fireworks exceptional events are shown in green triangles.

There were a number of fireworks displays across the Augusta area on July 4, 2023, as shown in the following snippet from https://www.wrdw.com/7/2023/07/01/here-are-some-4th-july-events-happening-across-csra/ . More information regarding the fireworks display at the baseball game can also be seen at https://www.youtube.com/watch?v=Mqh-CPq5sAg.

Several fireworks displays occurred around the same time of day causing an elevation in the $PM_{2.5}$ concentrations in the Augusta area on July 4, 2023. Figure 2 contains a list of fireworks displays in the Augusta area on July 4, 2023.

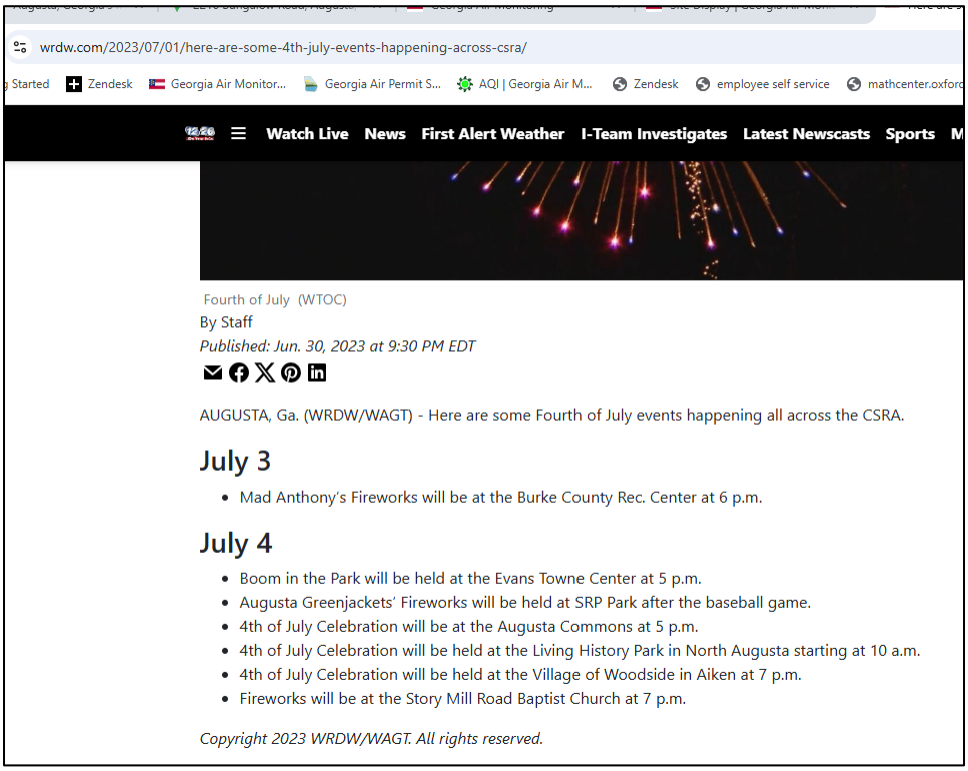

Figure 2. List of fireworks displays in the Augusta area on July 4, 2023.

Figure 3 shows the hourly $PM_{2.5}$ concentrations at the Augusta site on July 4 and July 5, 2023. Figure 4 compares the hourly $PM_{2.5}$ concentrations with the hourly wind direction and wind speed at the Augusta site on July 4 and 5, 2023. Figure 5 shows the windrose of the $PM_{2.5}$ concentrations with the wind direction and wind speed at the Augusta site on July 4 and 5, 2023. The primary wind direction was coming from the south and southwest (which is the location of the fireworks at the Story Mill Road Baptist Church) when the $PM_{2.5}$ concentrations were high at the August site. Figure 6 is a Google Earth map of the Augusta $PM_{2.5}$ site in relation to the locations of the fireworks displays on July 4, 2023. The distances are approximate and calculated with Google Earth.

In addition, Figure 7 shows the $PM_{2.5}$ speciation data collected at the Augusta site in 2023. The $PM_{2.5}$ speciation data is collected on a one in six-day schedule at the Augusta site, and the data was collected on July 5, 2023. The $PM_{2.5}$ speciation concentration on July 5, 2023, shows elevated potassium levels (shown with the pink and blue lines). Since potassium is found in the composition of fireworks, elevated potassium levels indicate that the high $PM_{2.5}$ measurements were impacted by fireworks.

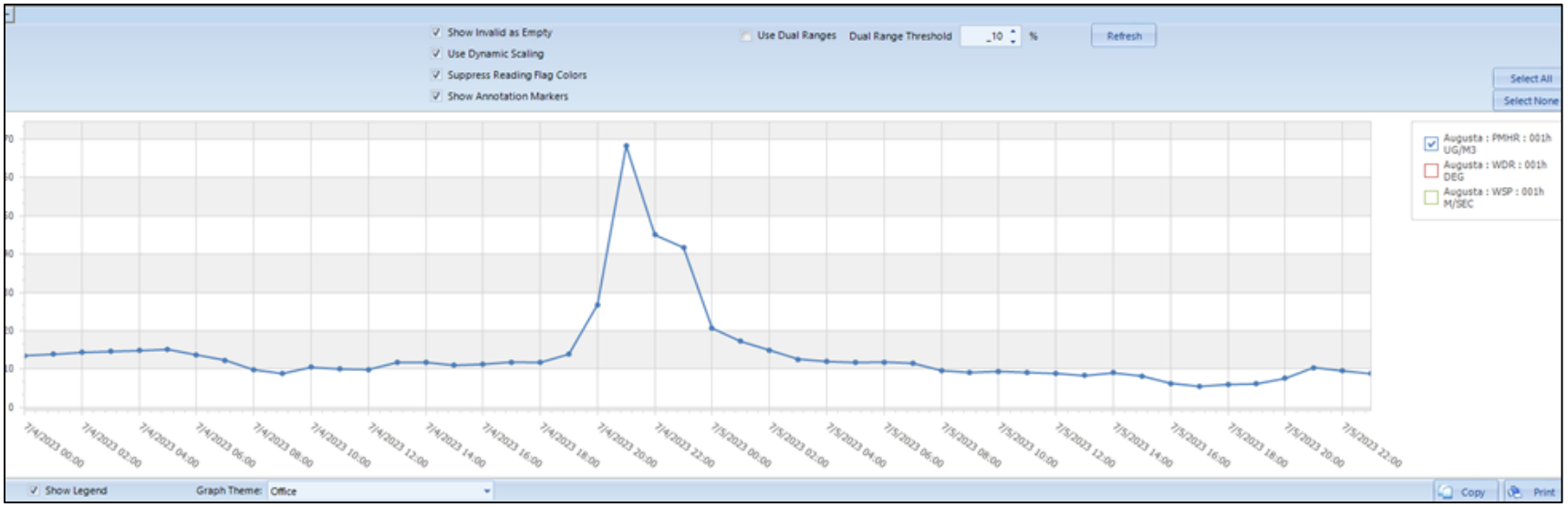

Figure 3. Hourly $PM_{2.5}$ concentrations at the Augusta site on July 4 and July 5, 2023.

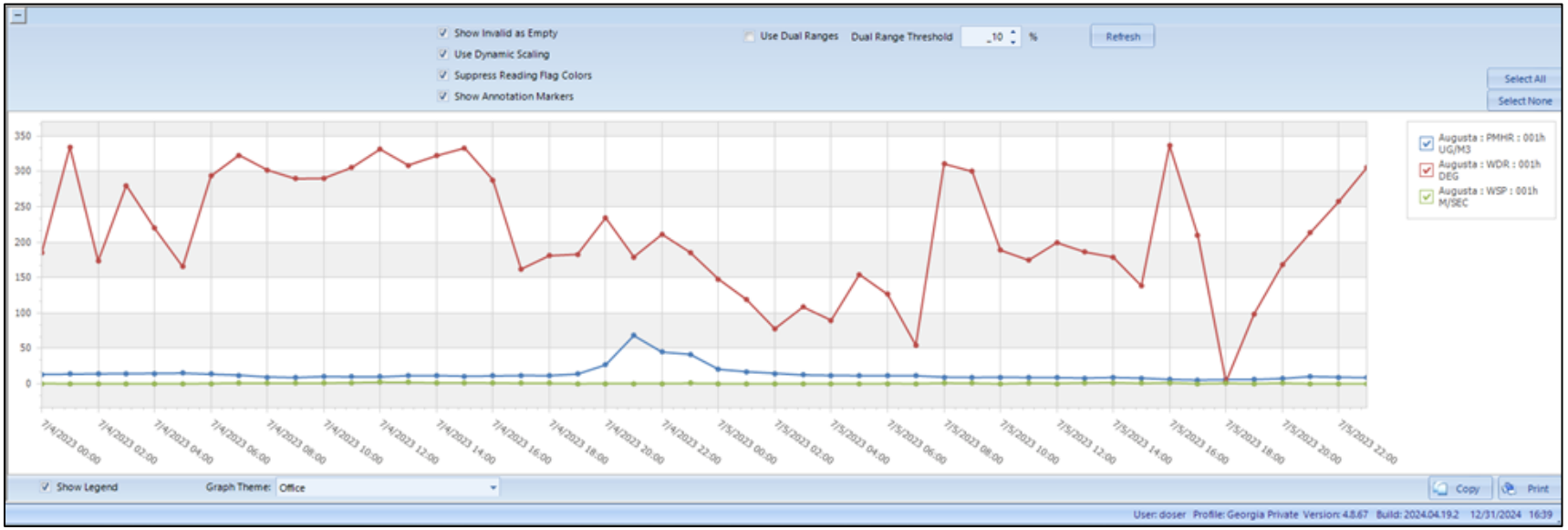

Figure 4. Hourly readings of $PM_{2.5}$, wind speed, and wind direction at the Augusta site on July 4 and July 5, 2023.

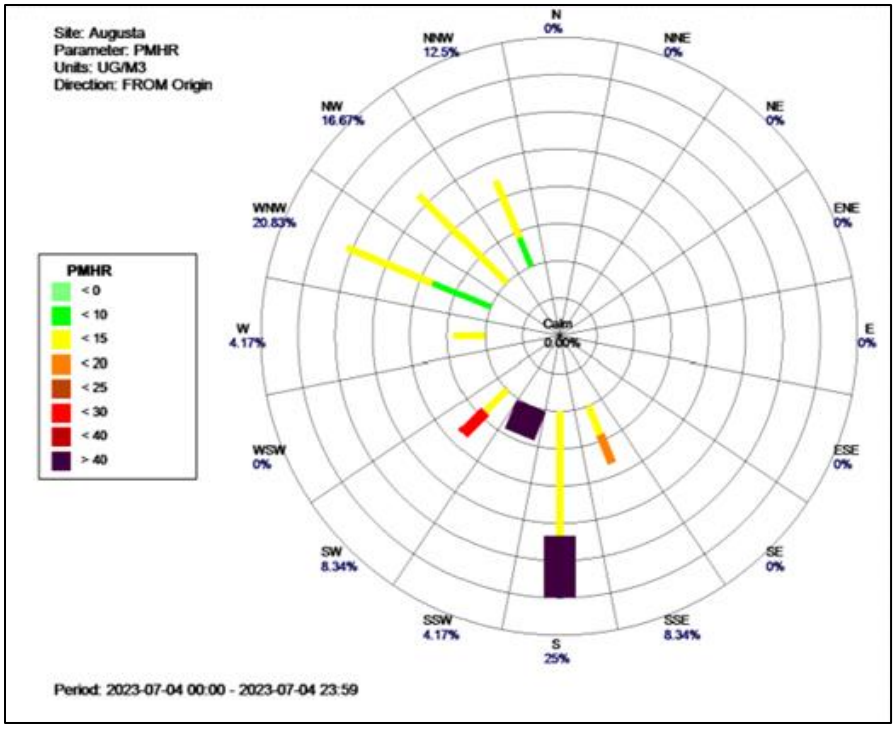

Figure 5. Windrose showing $PM_{2.5}$ concentrations and wind direction at the Augusta site on July 4, 2023.

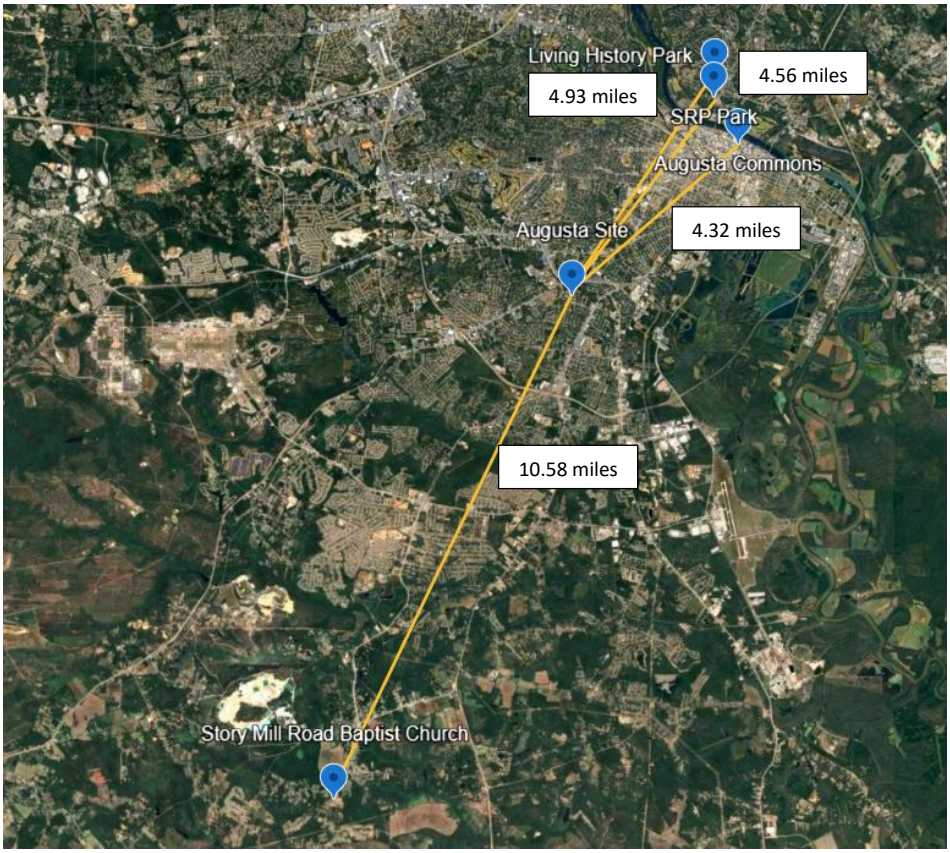

Figure 6. Locations of nearby fireworks and distances from the Augusta site.

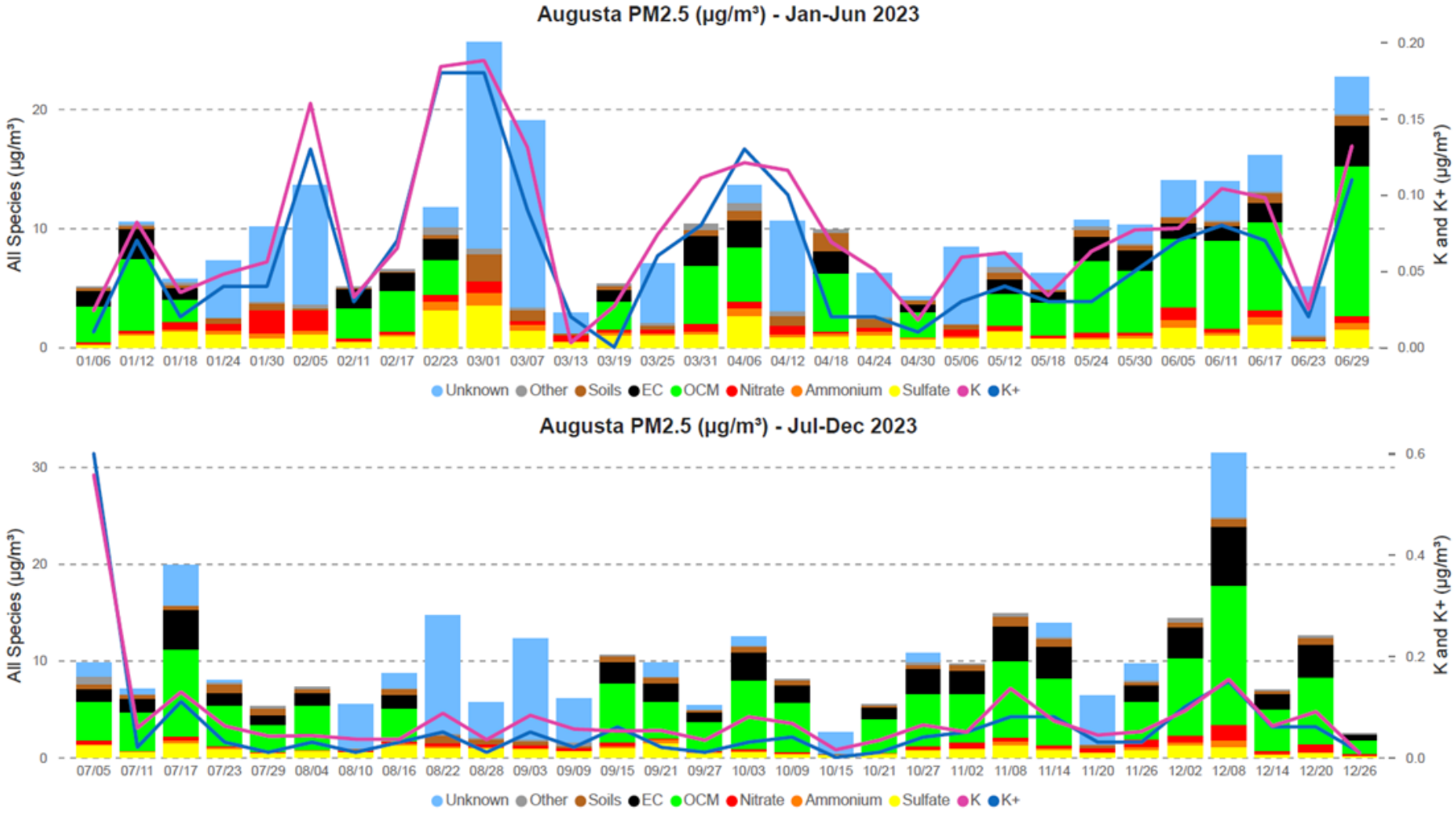

Figure 7. $PM_{2.5}$ speciation data at the Augusta site in 2023.

Appendix A contains integrated maps for each exceedance day and the day before. The maps include NOAA Hazard Mapping System (HMS) smoke plumes (light and dark grey shaded areas) and 24-hour $PM_{2.5}$ concentrations at the Augusta $PM_{2.5}$ monitor and other nearby monitors. Both maps contain 100-meter HYSPLIT back trajectories for all hourly measured $PM_{2.5}$ concentrations above 9.0 $\mu g/m^3$ on the exceedance day. Also, hourly $PM_{2.5}$ time series plots are shown for the day of the exceedance and the day before to demonstrate that fireworks smoke was transported to the Augusta monitor.

July 4, 2021

The exceedance on this day was due to firework smoke on the day before the exceedance (July 3) being transported in the early morning hours and firework smoke on the day of the exceedance (July 4) being transported in the late evening hours. Based on the time series plots, smoke from fireworks in Augusta was transported to the Augusta monitor between midnight and 8:00 AM and between 8:00 PM and midnight, leading to the exceedance.

July 5, 2021

The exceedance on this day was due to firework smoke on the day before the exceedance (July 4) being transported in the early morning hours. Based on the time series plots, smoke from fireworks in Augusta was transported to the Augusta monitor between midnight and 9:00 AM, leading to the exceedance.

July 4, 2023

The exceedance on this day was due to firework smoke on the day of the exceedance (July 4) being transported in the late evening hours. Based on the time series plots, smoke from fireworks in Augusta was transported to the Augusta monitor between 8:00 PM and midnight, leading to the exceedance.

On the three "Holiday Fireworks" dates listed in Table 1, fireworks generated smoke plumes resulting in elevated $PM_{2.5}$ concentrations at the Augusta monitor. The monitored $PM_{2.5}$ concentrations were more than four times the historical annual, quarterly, and monthly concentrations. In addition, the comparisons and analyses provided in Section 3 of this demonstration support our position that the fireworks events affected air quality in such a way that there exists a clear causal relationship between the specific events and the monitored $PM_{2.5}$ exceedances on the three "Holiday Fireworks" dates listed in Table 1 that have been requested for exclusion, and thus satisfies the clear causal relationship criterion.

4. Human Activity Unlikely to Recur at a Particular Location

This section addresses the EER requirement at 40 CFR 50.14(c)(3)(iv)(E), which requires that the event was either a human activity that is unlikely to recur at a particular location or a natural event. The fourth of July was established as a national holiday by Congress in 1870. According to the Library of Congress, "[b]y the 1870s, the Fourth of July was the most important secular holiday on the calendar. Congress passed a law making Independence Day a federal holiday on June 28, 1870."[8] As stated in Section 5, Georgia EPD cannot control or prevent legal fireworks

[8] https://www.loc.gov/item/today-in-history/july-04/#:~:text=Congress%20passed%20a%20law%20making,to%20congregate%20on%20Independence%20Day

from any location as part of the state statue. Holiday firework activities are unlikely to recur at a particular location outside this holiday.

5. Addressing the Not Reasonably Controllable or Preventable Criterion

This section addresses the EER requirement at 40 CFR 50.14(c)(3)(iv)(D) by demonstrating that the fireworks event was both not reasonably controllable and not reasonably preventable as part of the significantly integral, traditional national celebrations of July Fourth. Rules and Regulations of Georgia Rule 120-3-22-.13 Use of Fireworks[9] states:

> "*Consumer fireworks may be used, ignited, or caused to be ignited on any day between the hours of 10:00 A.M. and 11:59 P.M. unless during such times the noise from such use or ignition is not in compliance with a noise ordinance of a county or municipal corporation.*
> *Exception 1: Consumer fireworks may be used, ignited, or caused to be ignited on January 1, the last Saturday and Sunday in May, July 3, July 4, the first Monday in September, and December 31 of each year after the time of 10:00 A.M. and up to and including the time of 11:59 P.M.; and on January 1 of each year beginning at the time of 12:00 Midnight and up to and including the ending time of 1:00 A.M.*
> *Exception 2: After having obtained a special use permit as provided for in O.C.G.A. § 25-10- (a)(3)(D).*"

There are several areas of Georgia that have historically presented fireworks displays on July Fourth. Consequently, Georgia EPD cannot control or prevent legal fireworks as per state statute.

Based on the documentation provided in Section 5 of this submittal, the fireworks events satisfied the not reasonably controllable or preventable criterion. The events were not reasonably controllable because they were conducted as part of the significantly integral traditional national celebrations of July Fourth.

6. Public Comment

The Georgia EPD held a 30-day public comment period starting on December 20, 2024, to receive public input regarding the Exceptional Event Demonstration. Notification of the public comment period was posted on the Georgia EPD website and emailed to interested stakeholders. Public comments received are included in Appendix G of this demonstration, along with the Georgia EPD's responses to these comments in Appendix H.

7. Conclusions and Recommendations

This Exceptional Event demonstration has shown that the $PM_{2.5}$ monitor at Augusta was impacted by smoke from fireworks, causing $PM_{2.5}$ concentrations that exceeded the 2024 annual $PM_{2.5}$ NAAQS of 9.0 $\mu g/m^3$ on the three "Fireworks" dates listed in Table 1. The demonstration further shows that the prescribed fire events meet the EPA's definition of an Exceptional Event under the 2016 EER:

[9] https://rules.sos.ga.gov/gac/120-3-22

- Section 2. Narrative Conceptual Model includes a narrative conceptual model for the event, as required by 40 CFR 50.14(c)(3)(iv)(A).
- Section 3. Clear Causal Relationship includes a comparison to historical data, as required by 40 CFR 50.14(c)(3)(iv)(C), that shows the event concentration is very high compared to typical values measured at the site, and further demonstrates (through analysis of NOAA HMS smoke plumes, HYSPLIT trajectory modeling, and analysis of hourly $PM_{2.5}$ data) that emissions were transported to the monitor and caused the exceedance of the 2024 annual $PM_{2.5}$ NAAQS at the Augusta monitor, showing a clear causal relationship between the event and exceedance as required by 40 CFR 50.14(c)(3)(iv)(B).
- Section 4. Human Activity Unlikely to Recur at a Particular Location includes evidence that the fireworks event meets the EER definition of a human activity that is unlikely to recur at a particular location as required by 40 CFR 50.14(c)(3)(iv)(E), by establishing that the fireworks were part of a nationally significant cultural event and are unlikely to recur at a particular location outside this holiday.
- Section 5. Not Reasonably Controllable or Preventable includes evidence that the prescribed fire meets the EER definitions of being not reasonably controllable as required by 40 CFR 50.14(c)(3)(iv)(D), by showing that the fireworks were conducted as part of the significantly integral, traditional national celebrations of July Fourth as per *Rules and Regulations of the State of Georgia, Rule 120-3-22-.13 Use of Fireworks*.
- Additional procedural requirements such as identifying regulatory significance with respect to 40 CFR 50.14(a)(1)(i), documenting public notification of the event as required by 40 CFR 50.14(c)(1)(i), and providing for a public comment period for this demonstration as required in 40 CFR 50.14(c)(3)(v) have also been addressed in Sections 1. Introduction, 2. Narrative Conceptual Model, and 6. Public Comment.

Therefore, Georgia EPD requests that the EPA review and concur that this demonstration shows that the three holiday fireworks events in Table 1 meet the requirements of the EER, resulting in exclusion of the associated three daily $PM_{2.5}$ concentrations from regulatory decisions for the 2024 annual $PM_{2.5}$ NAAQS.

Appendices

A. Augusta Integrated Plots for Holiday Fireworks Exceptional Events by Date
G. Public Comments
H. Georgia EPD's Response to Comments