

STATE OF KANSAS



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GOVERNOR LAURA KELLY

February 5, 2025

Meg McCollister, Regional Administrator
USEPA, Region VII
11201 Renner Boulevard
Lenexa, KS 66219

Dear Ms. McCollister:

On February 7, 2024, the Environmental Protection Agency (EPA) promulgated a revised primary annual PM_{2.5} national ambient air quality standard (NAAQS) [89 FR 16202]. The process for designations following promulgation of new or revised NAAQS is contained in Section 107(d) of the Clean Air Act (Act). This section of the Act provides a process for the Governor to submit area designation recommendations of attainment, nonattainment, or unclassifiable, with appropriate boundaries, to EPA within one year of promulgation of a new or revised NAAQS. Kansas has until February 7, 2025, to submit designation recommendations for the 2024 Primary Annual PM_{2.5} NAAQS to EPA. This letter and enclosure are intended to fulfill this obligation for the State of Kansas.

Based on 2021-2023 quality assured complete ambient air quality data for all Kansas and nearby PM_{2.5} monitors, it was determined that there are three areas in Kansas (Wyandotte, Neosho and Sedgwick Counties) that are currently not meeting the 2024 Primary Annual PM_{2.5} National Ambient Air Quality Standard. The State of Kansas recommends that these three areas should be deemed as "unclassifiable" based on the discussion and analysis presented in the body of the attached technical document. In addition, Johnson County should be classified as "attainment" based on that monitor meeting the new standard and the remainder of the 101 counties in Kansas (as listed in Table 1 of the technical document) be designated individually as "unclassifiable/attainment" for the 2024 Primary Annual PM_{2.5} NAAQS. Please see enclosure for details supporting these designation recommendations.

These designation recommendations do not include any of the following Indian Country within Kansas: the Kickapoo Tribe in Kansas, the Sac and Fox Nation of Missouri in Kansas and Nebraska, the Prairie Band Potawatomi Nation and the Iowa Tribe in Kansas and Nebraska.

Please feel free to contact Leo Henning, Deputy Secretary and Director of the Division of Environment, at (785) 296-1534 or leo.henning@ks.gov if you have any questions regarding these designation recommendations.

Sincerely,

A handwritten signature in blue ink, appearing to read "Laura Kelly".

Laura Kelly
Governor of Kansas

Enclosure

cc: Janet Stanek, Secretary, KDHE
William Stone, USEPA, Region VII
Leo Henning, Deputy Secretary and Director, Division of Environment
Douglas Watson, Director, Bureau of Air



**2024 Primary Annual Fine Particulate Matter
(PM_{2.5}) National Ambient Air Quality Standard
Designation Recommendations for Kansas**

February 7, 2025

Kansas Department of Health and Environment
Division of Environment
Bureau of Air
1000 SW Jackson, Suite 310
Topeka, Kansas 66612
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Overview

On February 7, 2024, the Environmental Protection Agency (EPA) promulgated a revised primary annual PM_{2.5} national ambient air quality standard (NAAQS). The PM_{2.5} NAAQS was published in the Federal Register on March 6, 2024 [89 FR 16202]¹. In that action, the EPA revised the primary annual PM_{2.5} standard, strengthening it from 12.0 micrograms per cubic meter (µg/m³) to 9.0 µg/m³. In that same action, EPA retained the existing secondary annual standard for PM_{2.5}, the existing primary and secondary 24-hour standards for PM_{2.5}, and the existing primary and secondary standards for particulate matter with aerodynamic diameters of 10 microns or less (PM₁₀).

Section 107(d) of the Clean Air Act requires each state to submit area designation recommendations of attainment, nonattainment, or unclassifiable, with appropriate boundaries, to EPA within one year of promulgation of a new or revised NAAQS. EPA can either accept the recommendations or make modifications, as necessary. Section 107(d)(1)(A) of the Clean Air Act defines a nonattainment area as any area that does not meet or that contributes to nearby areas not meeting the NAAQS.

Kansas has until February 7, 2025, to submit designation recommendations for the 2024 Primary Annual PM_{2.5} NAAQS to EPA. EPA will then notify Kansas concerning any modifications to the recommendations and allow for comments to their changes by Mid-October 2025. Kansas then has until Mid-November 2025 to comment on the EPA modified recommendations, which will be finalized by February 6, 2026.

The purpose of this document is to summarize the analysis prepared to support the Kansas 2024 Primary Annual PM_{2.5} designation recommendations to EPA. This analysis is based on information and data collected for calendar years 2021 – 2023, and the February 7, 2024 EPA Memorandum *Initial Area Designations for the 2024 Revised Primary Annual Fine Particle National Ambient Air Quality Standard*.²

Summary of Recommendation

Based on 2021 – 2023 quality assured complete ambient air quality data for all Kansas and nearby PM_{2.5} monitors, it was determined that there are three areas in Kansas (Wyandotte, Neosho, and Sedgwick Counties) that are currently not meeting the 2024 Primary Annual PM_{2.5} National Ambient Air Quality Standard. The State of Kansas recommends that these three areas should be deemed as “unclassifiable” based on the discussion and analysis presented in the body of this document. In addition, Johnson County should be classified as “attainment” and the remainder of the 101 counties in Kansas (as listed in Table 1) be designated individually as “unclassifiable/attainment” for the 2024 Primary Annual PM_{2.5} NAAQS.

These designation recommendations do not include any of the following areas of Indian Country within Kansas: the Prairie Band of the Potawatomi Indian Reservation, the Kickapoo Nation Indian Reservation, the Sac and Fox Tribe Indian Reservation, and the Iowa Tribe Indian Reservation.

¹ <https://www.epa.gov/system/files/documents/2024-04/2024-pm-naaqs-fr-published.pdf>

² https://www.epa.gov/system/files/documents/2024-02/pm-naaqs-designations-memo_2.7.2024--jg-signed.pdf

Table 1. Kansas Classification Recommendations for the 2024 Primary Annual PM_{2.5} NAAQS	
County	Classification Recommendation
Allen	unclassifiable/attainment
Anderson	unclassifiable/attainment
Atchison	unclassifiable/attainment
Barber	unclassifiable/attainment
Barton	unclassifiable/attainment
Bourbon	unclassifiable/attainment
Brown	unclassifiable/attainment
Butler	unclassifiable/attainment
Chase	unclassifiable/attainment
Chautauqua	unclassifiable/attainment
Cherokee	unclassifiable/attainment
Cheyenne	unclassifiable/attainment
Clark	unclassifiable/attainment
Clay	unclassifiable/attainment
Cloud	unclassifiable/attainment
Coffey	unclassifiable/attainment
Comanche	unclassifiable/attainment
Cowley	unclassifiable/attainment
Crawford	unclassifiable/attainment
Decatur	unclassifiable/attainment
Dickinson	unclassifiable/attainment
Doniphan	unclassifiable/attainment
Douglas	unclassifiable/attainment
Edwards	unclassifiable/attainment
Elk	unclassifiable/attainment
Ellis	unclassifiable/attainment
Ellsworth	unclassifiable/attainment
Finney	unclassifiable/attainment
Ford	unclassifiable/attainment
Franklin	unclassifiable/attainment
Geary	unclassifiable/attainment
Gove	unclassifiable/attainment
Graham	unclassifiable/attainment
Grant	unclassifiable/attainment
Gray	unclassifiable/attainment
Greeley	unclassifiable/attainment
Greenwood	unclassifiable/attainment
Hamilton	unclassifiable/attainment
Harper	unclassifiable/attainment
Harvey	unclassifiable/attainment

County	Classification Recommendation
Haskell	unclassifiable/attainment
Hodgeman	unclassifiable/attainment
Jackson	unclassifiable/attainment
Jefferson	unclassifiable/attainment
Jewell	unclassifiable/attainment
Johnson	attainment
Kearny	unclassifiable/attainment
Kingman	unclassifiable/attainment
Kiowa	unclassifiable/attainment
Labette	unclassifiable/attainment
Lane	unclassifiable/attainment
Leavenworth	unclassifiable/attainment
Lincoln	unclassifiable/attainment
Linn	unclassifiable/attainment
Logan	unclassifiable/attainment
Lyon	unclassifiable/attainment
Marion	unclassifiable/attainment
Marshall	unclassifiable/attainment
McPherson	unclassifiable/attainment
Meade	unclassifiable/attainment
Miami	unclassifiable/attainment
Mitchell	unclassifiable/attainment
Montgomery	unclassifiable/attainment
Morris	unclassifiable/attainment
Morton	unclassifiable/attainment
Nemaha	unclassifiable/attainment
Neosho	unclassifiable
Ness	unclassifiable/attainment
Norton	unclassifiable/attainment
Osage	unclassifiable/attainment
Osborne	unclassifiable/attainment
Ottawa	unclassifiable/attainment
Pawnee	unclassifiable/attainment
Phillips	unclassifiable/attainment
Pottawatomie	unclassifiable/attainment
Pratt	unclassifiable/attainment
Rawlins	unclassifiable/attainment
Reno	unclassifiable/attainment
Republic	unclassifiable/attainment
Rice	unclassifiable/attainment
Riley	unclassifiable/attainment

County	Classification Recommendation
Rooks	unclassifiable/attainment
Rush	unclassifiable/attainment
Russell	unclassifiable/attainment
Saline	unclassifiable/attainment
Scott	unclassifiable/attainment
Sedgwick	unclassifiable
Seward	unclassifiable/attainment
Shawnee	unclassifiable/attainment
Sheridan	unclassifiable/attainment
Sherman	unclassifiable/attainment
Smith	unclassifiable/attainment
Stafford	unclassifiable/attainment
Stanton	unclassifiable/attainment
Stevens	unclassifiable/attainment
Sumner	unclassifiable/attainment
Thomas	unclassifiable/attainment
Trego	unclassifiable/attainment
Wabaunsee	unclassifiable/attainment
Wallace	unclassifiable/attainment
Washington	unclassifiable/attainment
Wichita	unclassifiable/attainment
Wilson	unclassifiable/attainment
Woodson	unclassifiable/attainment
Wyandotte	unclassifiable

Technical Considerations

These recommendations have been developed based on a review of the technical information as suggested by the February 7, 2024 EPA guidance and a separate review of available information and analysis by the State. The following is a summary of the ambient air quality monitoring data in all relevant Kansas counties and in all relevant counties in nearby states.

Figure 1 displays the Kansas PM_{2.5} ambient air monitoring network. Table 2 lists the 2021–2023 design values for all equivalent method ambient PM_{2.5} monitors.

Figure 2 displays the PM_{2.5} annual mean values from 2002–2023 for all monitors in Kansas for comparison to the annual PM_{2.5} NAAQS. As seen in this figure, there was an evident overall decline in annual PM_{2.5} concentrations from 2002 until the approximate 2016 to 2018 timeframe in Kansas. It is during that same time (2016-2018) that the state began transitioning from a filter-based PM_{2.5} network to a continuous monitor network. The Teledyne Advanced Pollution Instrumentation (TAPI) Model T640 PM mass monitor (T640) and TAPI Model T640 with 640X option (T640X) were each approved as Federal Equivalency Method (FEM) monitors for PM_{2.5} by the EPA’s Reference and Equivalency Program and

Figure 1. Kansas PM_{2.5} Monitoring Network (2021–2023)

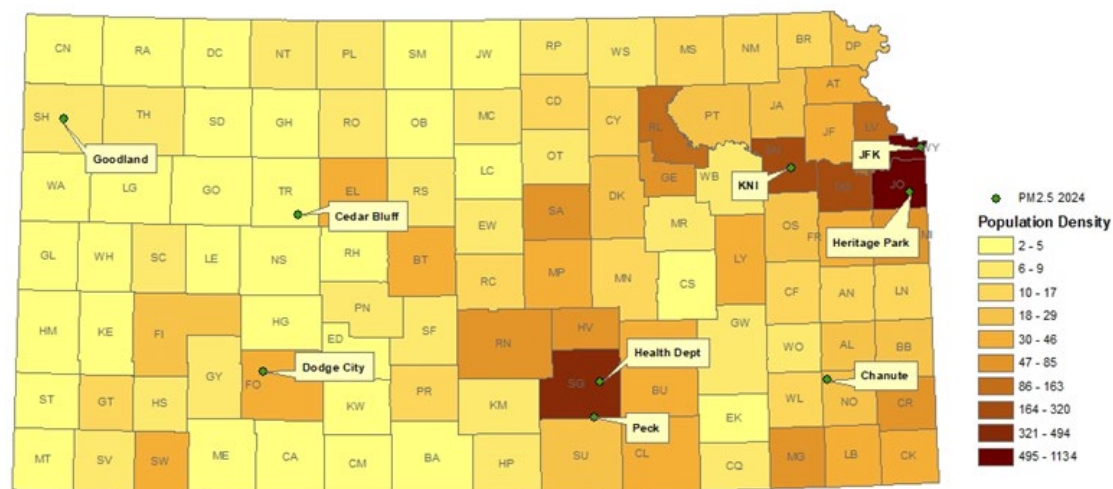


Table 2. Kansas Ambient PM_{2.5} Monitor Design Values (2021–2023)

Site Name	AQS Site ID	County	2021–2023 Annual PM _{2.5} Design Value (µg/m ³)
Dodge City	20-057-0002	Ford	***
Heritage Park	20-091-0010	Johnson	8.3
Chanute	20-133-0003	Neosho	9.3
Wichita Health Department	20-173-0010	Sedgwick	9.7
KNI	20-177-0013	Shawnee	8.8*
Goodland	20-181-0003	Sherman	4.3**
Peck	20-191-0002	Sumner	8.9*
Cedar Bluff	20-195-0001	Trego	6.8*
JFK	20-209-0021	Wyandotte	9.6

*- Did not meet data completeness requirements

** - New monitor installed March 21, 2023

*** - New monitor installed September 19, 2023

announced in the *Federal Register* on July 13, 2016 (81 FR 45285). By early 2017, state monitoring agencies began operating T640 and T640X PM FEMs in their networks and reporting data to EPA’s Air Quality System (AQS) database. The adoption of T640 and T640X PM_{2.5} FEMs proceeded across the country with states reporting at least some data for about 30 such monitors in 2017, and more recently reporting data for about 400 T640 and T640X PM_{2.5} FEMs in 2023 (Figure 3). The State chose TAPI T640(x) continuous

Figure 2. PM_{2.5} Annual Mean Values for Kansas Monitors (2002-2023)

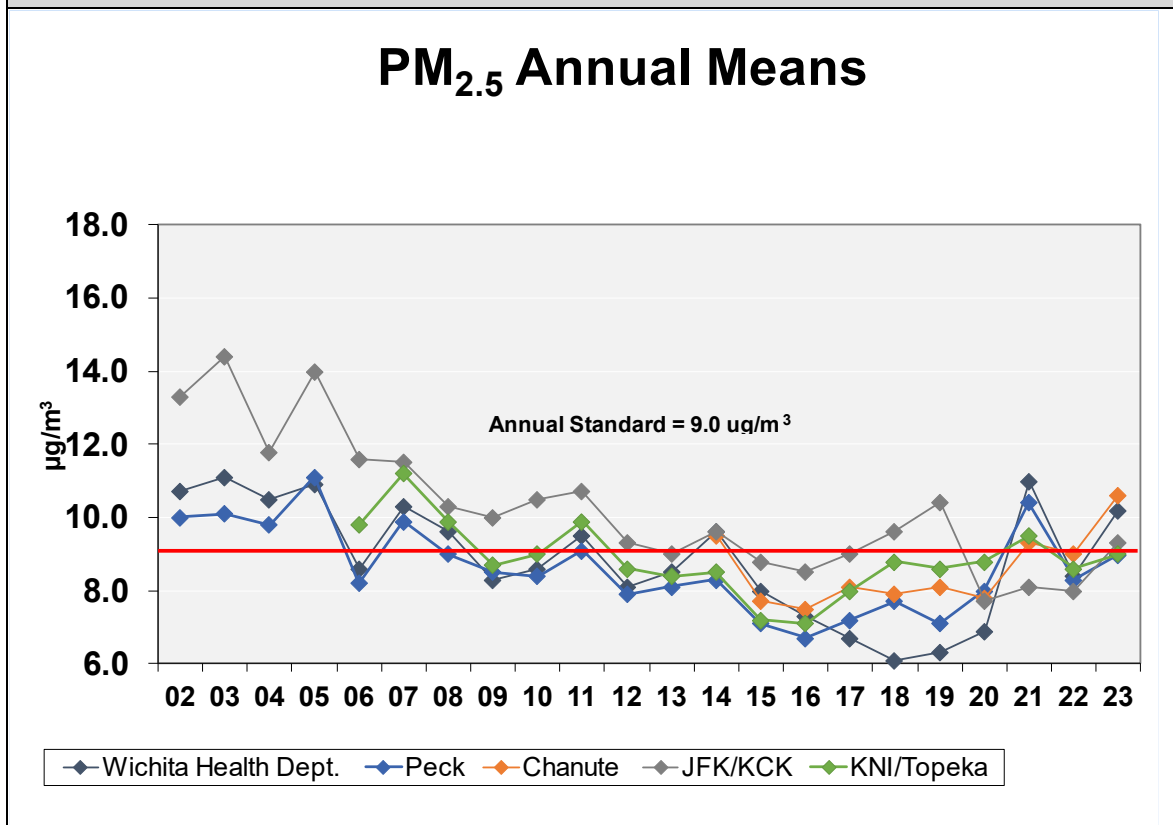
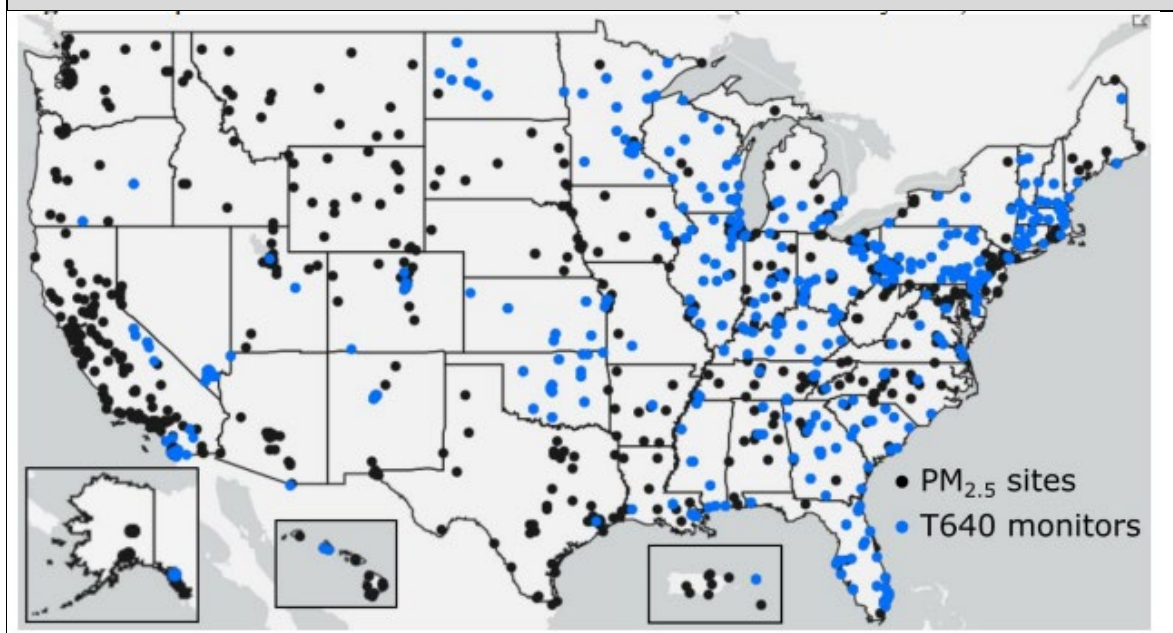


Figure 3. PM_{2.5} Monitoring Sites and Location of T640 Monitors (2023)



monitors to operate in place of the filter-based monitors that had been in place since the beginning of the PM_{2.5} monitoring program in the state. This monitor is an EPA-approved FEM and was chosen for its ease of use that required fewer operator visits, lower maintenance requirements, operational dependability, and allowed the ability to provide multiple PM metrics from one instrument (i.e., the T640X provides data for PM₁₀, PM_{2.5}, and PM_{10-2.5}). In addition, the State believed that transitioning to a continuous PM_{2.5} network would be beneficial to both the State and the public as it could potentially allow for more alerts of PM_{2.5} events as they occurred. Table 3 shows the PM_{2.5} monitoring locations in the state and the timeframe that the State installed TAPI T640(X) at each location, and the date that the data alignment firmware update at each site was accomplished (this firmware update will be explained in more detail later in this document).

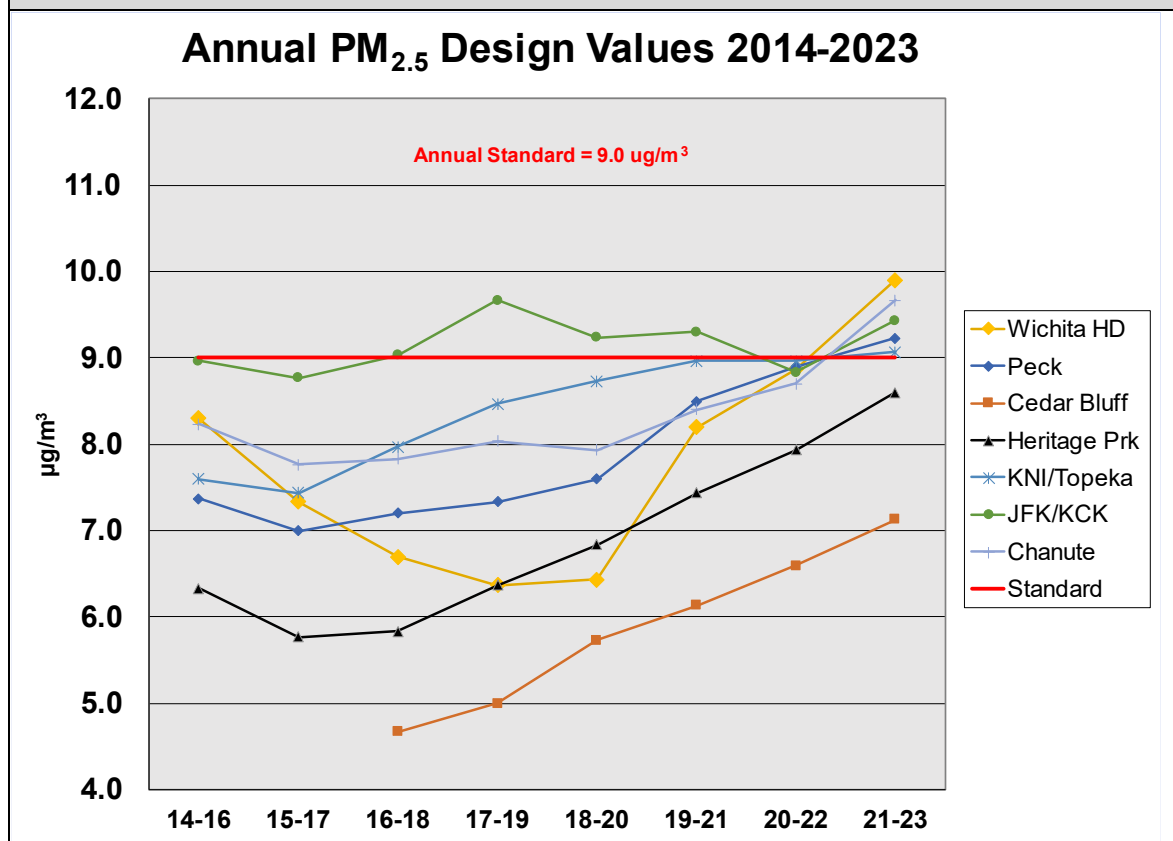
Table 3. T640X Begin Operation Dates and Data Alignment Dates

Site Name	AQS Site ID	County	Method Code	Begin Date	End Date
Heritage Park	20-091-0010	Johnson	238	7/10/2020	8/29/2023
Data Align			638	8/30/2023	
Chanute	20-133-0003	Neosho	238	11/14/2018	9/11/2023
Data Align			638	9/12/2023	
Wichita HD	20-173-0010	Sedgwick	238	7/7/2021	9/12/2023
Data Align			638	9/13/2023	
KNI-Topeka	20-177-0013	Shawnee	236(T640)	6/1/2017	9/15/2020
			238(T640X)	9/16/2020	8/22/2023
Data Align			638	8/23/2023	
Peck	20-191-0002	Sumner	238	9/12/2019	10/16/2023
Data Align			638	10/17/2023	
Cedar Bluff	20-195-0001	Trego	238	5/19/2020	9/19/2023
Data Align			638	9/20/2023	
JFK-KCK	20-209-0021	Wyandotte	238	11/7/2019	8/23/2023
Data Align			638	8/24/2023	

Figure 4 shows the 3-year annual design values for the period 2014 to 2023 for the Kansas PM_{2.5} network. Like the annual means, the design values have been increasing since the 2017 to 2019 period across the network. The State believes this is related to the installation of the T640X monitoring equipment and a significant increase in the number of smoke intrusion days across Kansas from both prescribed fires and wildfires.

From early in the use of the T640(X), monitoring agencies, including Kansas, reported a positive bias resulting in higher PM concentrations relative to collocated Federal Reference Method (FRM) monitors. The bias of T640 and T640X PM_{2.5} FEMs has been reported as relatively consistent across sites and methods with continuous FEMs reading about 20% higher than collocated FRMs. Even higher positive biases have been reported for sites with smoke impacts from fires. In addition to evaluating bias by comparing continuous FEMs collocated with FRMs operated by the same monitoring agency, the EPA and the states run an independent audit program for PM_{2.5} methods known as the Performance

Figure 4. Annual PM_{2.5} Design Values for Kansas Monitors (2014-2023)



Evaluation Program (PEP). This program brings portable PM_{2.5} FRM samplers to sites across the country each year where a primary sampler of a subset of sites in each Primary Quality Assurance Organization (PQAO) are independently audited. Data from the PM_{2.5} Performance Evaluation Program (PEP) had indicated a consistent positive bias for the T640 and T640X PM_{2.5} FEMs compared to audit FRMs; however, this bias was not as pronounced as the bias data from FRM samplers run by the monitoring agencies.³

In April 2023, under the Reference and Equivalent Method Program at 40 CFR 53.14, the EPA approved a modification of the FEM designation for the TAPI Model T640 PM mass monitor, including the T640X option, to allow operation of the monitors with or without a Network Data Alignment. At that time, the potential need for a Network Data Alignment of the T640 and T640X PM_{2.5} concentrations had been identified in peer-reviewed literature reporting a generally high bias for the T640 and T640X monitors relative to the Federal Reference Method (FRM) and other FEM monitors.^{4,5} Subsequently, TAPI developed a Network Data Alignment utilizing a national dataset from routinely operated

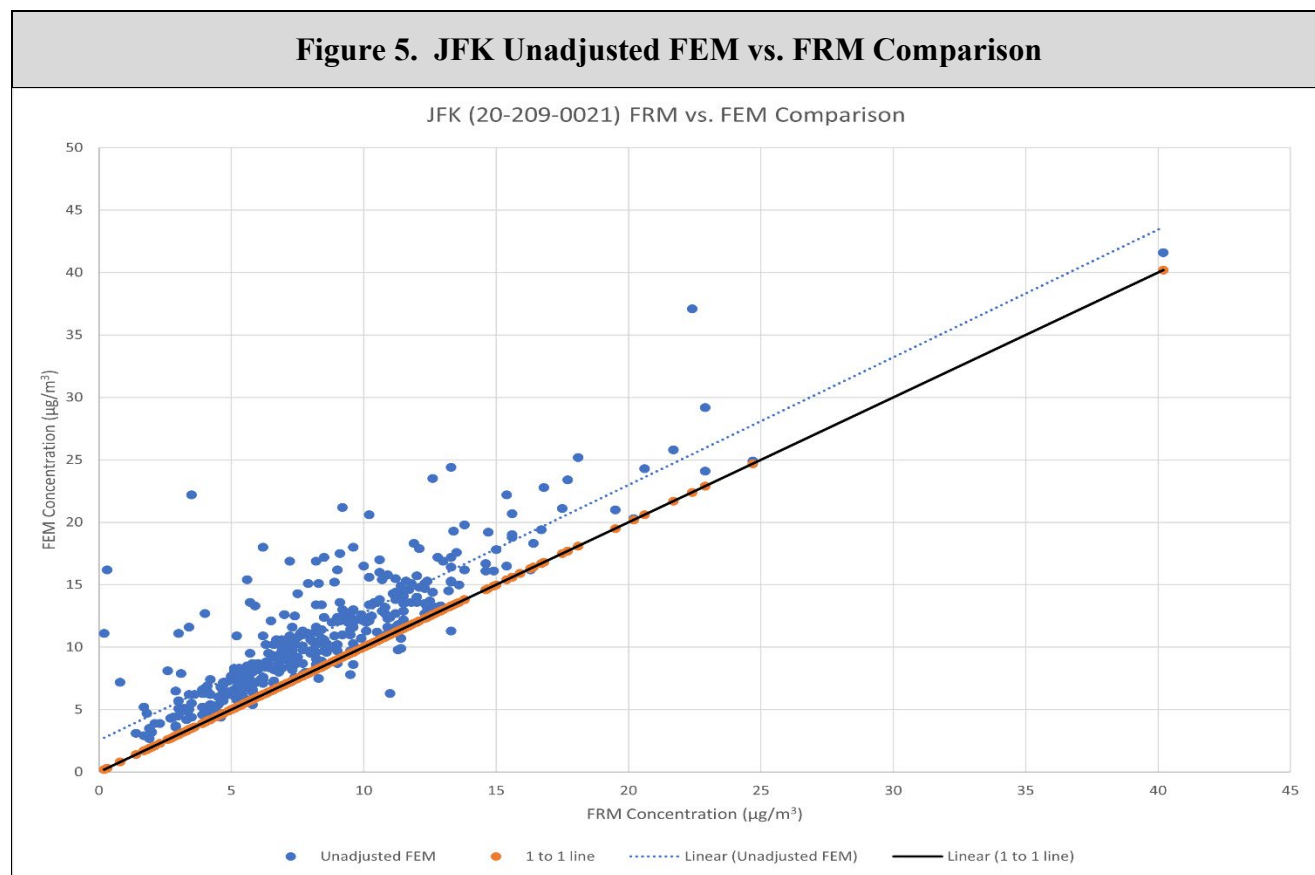
³ https://www.epa.gov/system/files/documents/2024-05/2_supplemental-info_t640-data-update_final-05-13-2024.pdf

⁴ Hagler, G.; Hanley, T.; Hassett-Sipple, B.; Vanderpool, R.; Smith, M.; Wilbur, J.; Wilbur, T.; Oliver, T.; Shand, D.; Vidacek, V.; Johnson, C.; Allen, R.; D'Angelo, C.: Evaluation of two collocated federal equivalent method PM_{2.5} instruments over a wide range of concentrations in Sarajevo, Bosnia and Herzegovina. *Atmospheric Pollution. Research*, 13(4), 101374, 2022.

⁵ Long, R.; Urbanski, S.; Lincoln, E.; Colón, M.; Kaushik, S.; Krug, J.; Vanderpool R.; Landis, M.: Summary of PM_{2.5} measurement artifacts associated with the Teledyne T640 PM Mass Monitor under controlled chamber experimental conditions using polydisperse ammonium sulfate aerosols and biomass smoke, *Journal of the Air & Waste Management Association*, 73(4), 295-312, 2023.

collocated PM_{2.5} FRMs and T640 and T640X FEMs. Because of the importance of these data for regulatory, scientific, and public use, the EPA retroactively applied the Network Data Alignment equations to all the hourly unaligned T640 and T640X PM_{2.5} concentrations in the EPA’s Air Quality System (AQS) for data beginning in 2017, when the T640 and T640X monitors started being deployed across the U.S. Based on the State’s reading of TAPI’s data adjustment, only temperature and PM concentrations were used to correct the data.⁶ Neither TAPI nor EPA corrected the data for the known smoke bias in the T640X monitor.

To get a better understanding of the bias between the T640X and the FRM, an analysis of the data from collocated monitors is preferred. Unfortunately, since the State adopted the continuous monitors across the network, there remains only one site in Kansas City, KS (JFK, Site 20-209-0021) where both a T640X and a FRM exist for analysis. Figure 5 compares the JFK unadjusted 24-hour FEM data with the 24-hour FRM data from late November 2019 through early August 2023. The Teledyne firmware update was applied across Kansas’ network between late August and mid-October 2023. JFK was updated on August 24, 2023 (Table 3). The high bias is clearly shown with most of the FEM concentrations reading significantly higher than the FRM concentrations. Teledyne created an adjustment factor to be applied to the FEM data with the expectation to correct the known bias issue.



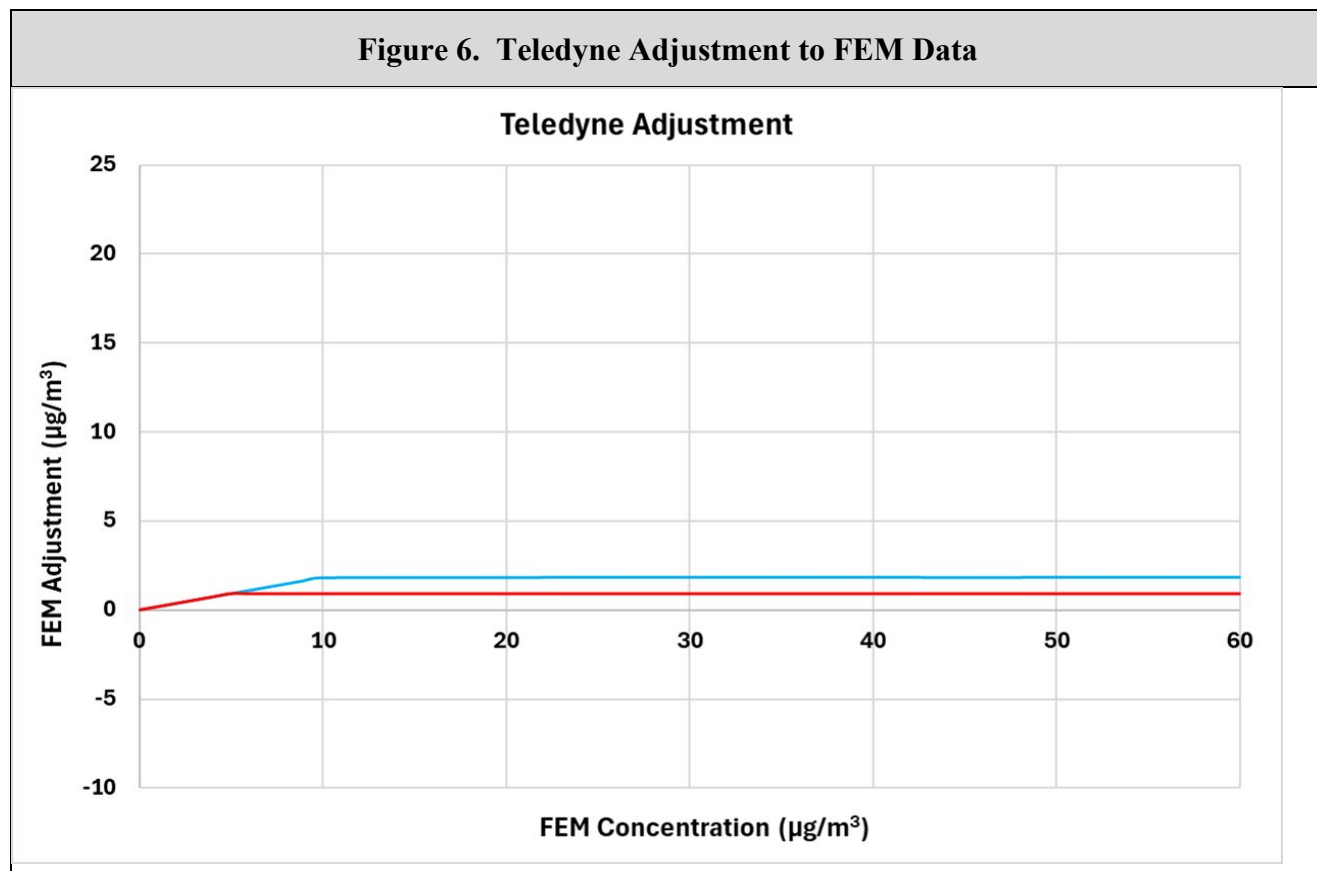
The Teledyne T640/T640X alignment algorithm implemented by EPA in the federal air quality system (AQS) database is shown in Table 4.

⁶ <https://www.regulations.gov/document/EPA-HQ-OAR-2023-0642-0029>

- If the ambient temperature is at or below 20°C
 - T640/x raw PM value is less than or equal to 10ug/m3, then multiply the T640/x raw PM value by 0.813233
 - T640/x raw PM value is greater than 10ug/m3, then use the equation (T640/x raw PM – 1.861)
- If the ambient temperature is above 20°C
 - T640/x raw PM value is less than or equal to 5ug/m3, then multiply the T640/x raw PM value by 0.813233
 - T640/x raw PM value is greater than 5ug/m3, then use the equation (T640/x raw PM – 0.925)

Table 4. Teledyne T640/T640X Alignment Algorithm Implemented by EPA					
CASE	PM _{2.5} Conc.	Temp. ≤ 20° C	CASE	PM _{2.5} Conc.	Temp. > 20° C
A	≤ 10 µg/m ³	T640/x * 0.813233	C	≤ 5 µg/m ³	T640/x * 0.813233
B	> 10 µg/m ³	T640/x – 1.861	D	> 5 µg/m ³	T640/x – 0.925

Figure 6 graphically displays the expected bias correction needed as a function of uncorrected FEM concentration and temperature based on the equations listed in Table 4. This alignment algorithm calculation depends on the ambient temperature at the time the data was collected, as well as the raw



FEM concentrations that were collected. According to the alignment factor calculations that were implemented in the new T640/T640X software, the adjustment for the FEM data would fall along the blue line for PM_{2.5} FEM data collected with the ambient temperature $\leq 20^{\circ}\text{C}$ (Cases A and B from Table 4), and along the red line for PM_{2.5} FEM data collected with the temperature $>20^{\circ}\text{C}$ (Cases C and D from Table 4).

Figure 7 shows the difference between the unadjusted FEM concentrations and the FRM concentrations (y-axis) at JFK as a function of unadjusted FEM concentration (x-axis) from late November 2019 through early August 2023. The figure clearly shows that the bias increases as the uncorrected FEM concentration increases. However, the Teledyne adjustment algorithm applies a fixed adjustment of $0.925\ \mu\text{g}/\text{m}^3$ when the temperature is above 20°C and the FEM concentration is above $5\ \mu\text{g}/\text{m}^3$, and $1.861\ \mu\text{g}/\text{m}^3$ when the temperature is at or below 20°C and the FEM concentration is above $10\ \mu\text{g}/\text{m}^3$. The form of the Teledyne bias adjustment algorithm does not match the actual bias shown in the JFK data.

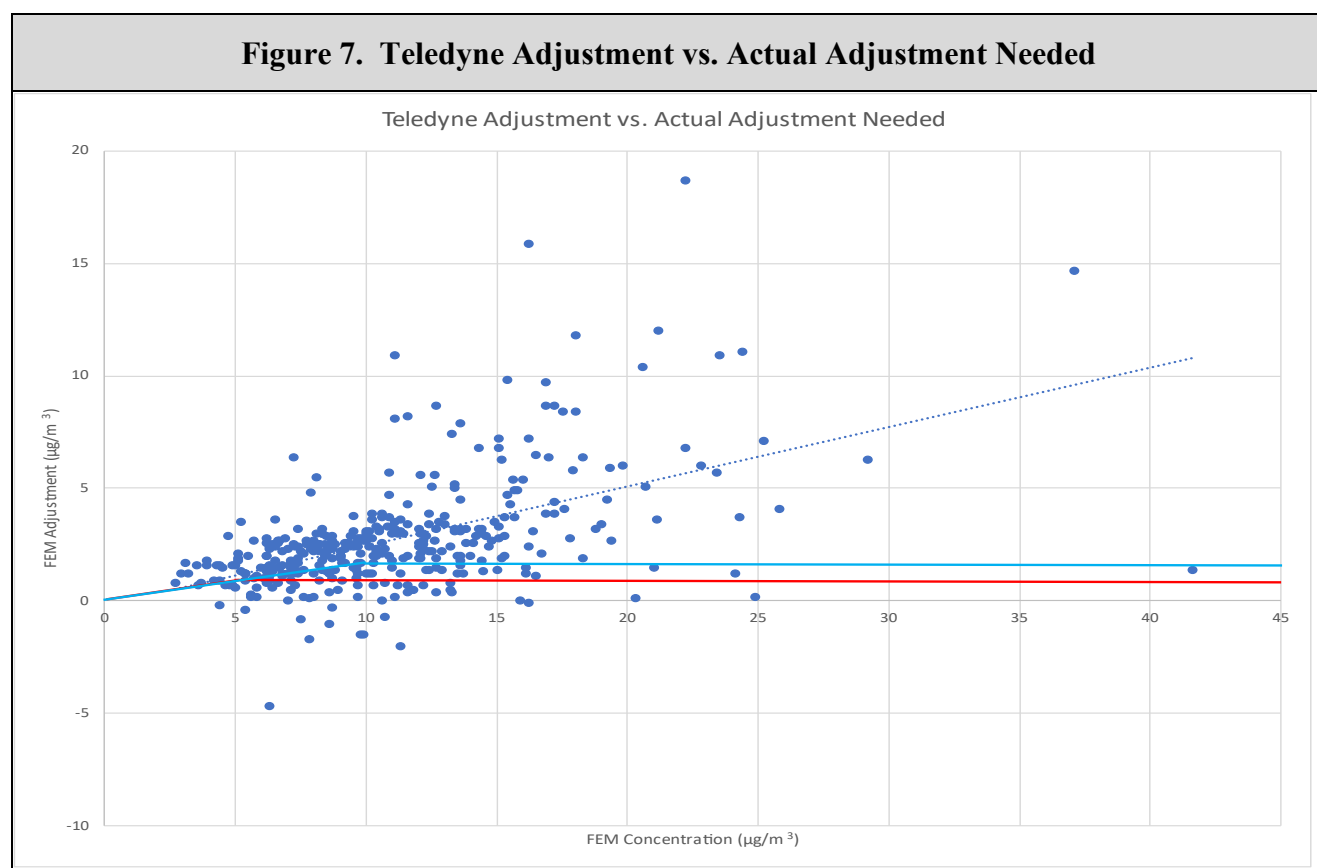
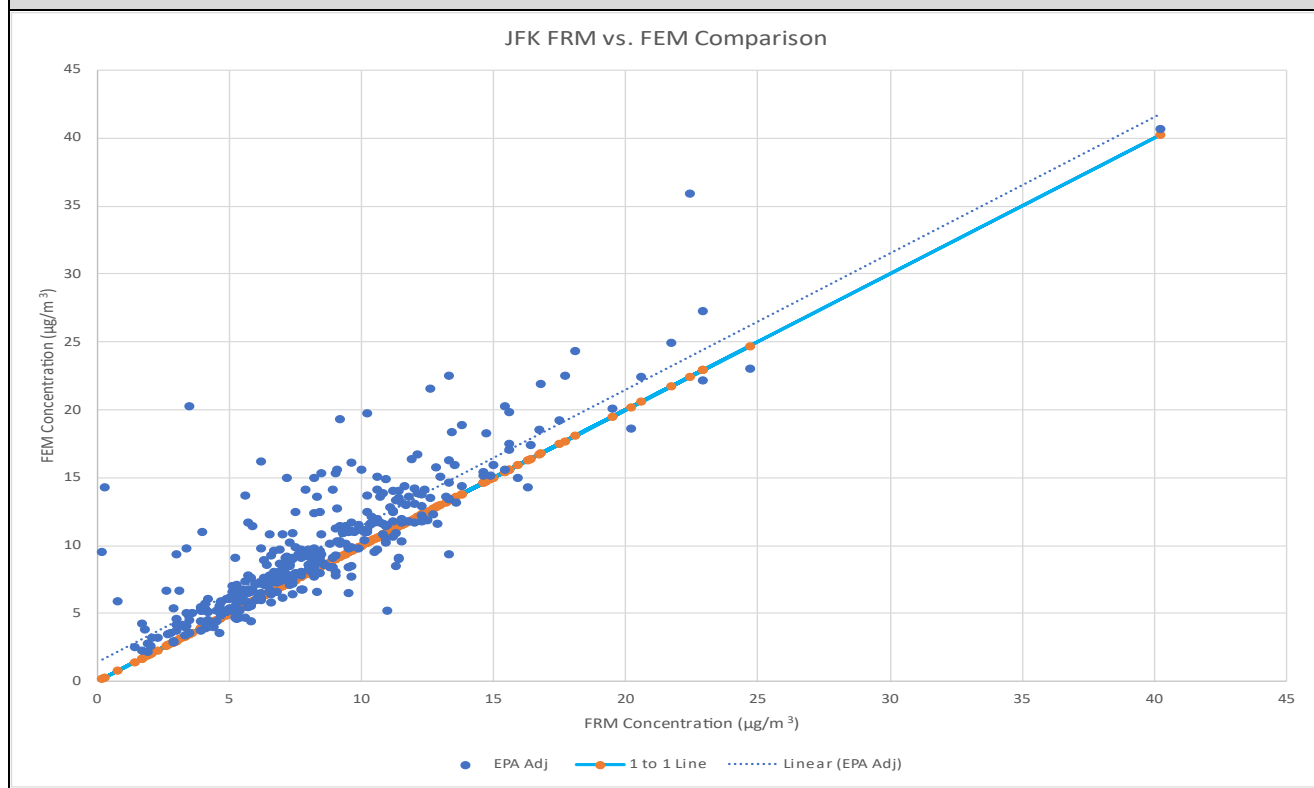


Figure 8 displays the JFK FEM concentrations that have been corrected by EPA with the Teledyne alignment algorithm (y-axis) compared to the FRM concentrations (x-axis) from late November 2019 through early August 2023. Ideally, the best fit regression line and the 1:1 line should overlap each other. In this analysis, the best fit regression line continues to be above the 1:1 line indicating the “corrected” FEM measurements are still higher than the FRM measurements after the FEM data has been adjusted with the Teledyne alignment algorithm. Kansas is aware the State of Georgia has undertaken a comprehensive review of EPA’s implementation of the alignment factor on historical data, and has found numerous errors, as well as

Figure 8. JFK FRM vs. FEM EPA Adj Comparison



continuing lack of good comparison between FRMs and the corrected FEM data. The state of Georgia examined a simpler version of the Teledyne alignment algorithm that used a single equation regardless of temperature and concentration. The alternative alignment algorithm simply multiplies the uncorrected FEM concentration by a single value of 0.813233. Georgia's alternate alignment factor allows the FEM data to match more closely with FRM data. Figure 9 displays the JFK FEM concentrations that have been corrected by using the Georgia algorithm (y-axis) compared to the FRM concentrations (x-axis) from late November 2019 through early August 2023. Although not a perfect match with the 1:1 line, the Georgia adjustment algorithm appears to adjust the JFK FEM data better than the EPA/Teledyne adjustment. We can also see this change by examining the normalized mean bias between the FEM and FRM concentrations (from late November 2019 through early August 2023) using the following formula:

- Normalized Mean Bias (%) = (average FEM – average FRM)/(average FRM).

Table 5 shows the unadjusted FEM bias in the second column, the EPA Adjusted FEM bias with the Teledyne alignment algorithm in the third column, and the Georgia Adjusted FEM bias using the 0.813233 factor in the fourth column. The unadjusted T640/T640X FEM data at JFK is biased high by 32.78% as compared to the JFK FRM data. The EPA alignment algorithm reduces the bias at JFK to 17.54%. The Georgia Adjusted FEM approach reduced the bias at JFK to 7.98%. The State believes that this bias is still unacceptably high at 17.54% using the EPA/Teledyne correction algorithm and would be reduced even more at this site if additional adjustments were made to the T640X data like the Georgia technique and for the monitor's known smoke bias.

Figure 9. JFK FRM vs. FEM Georgia Adj

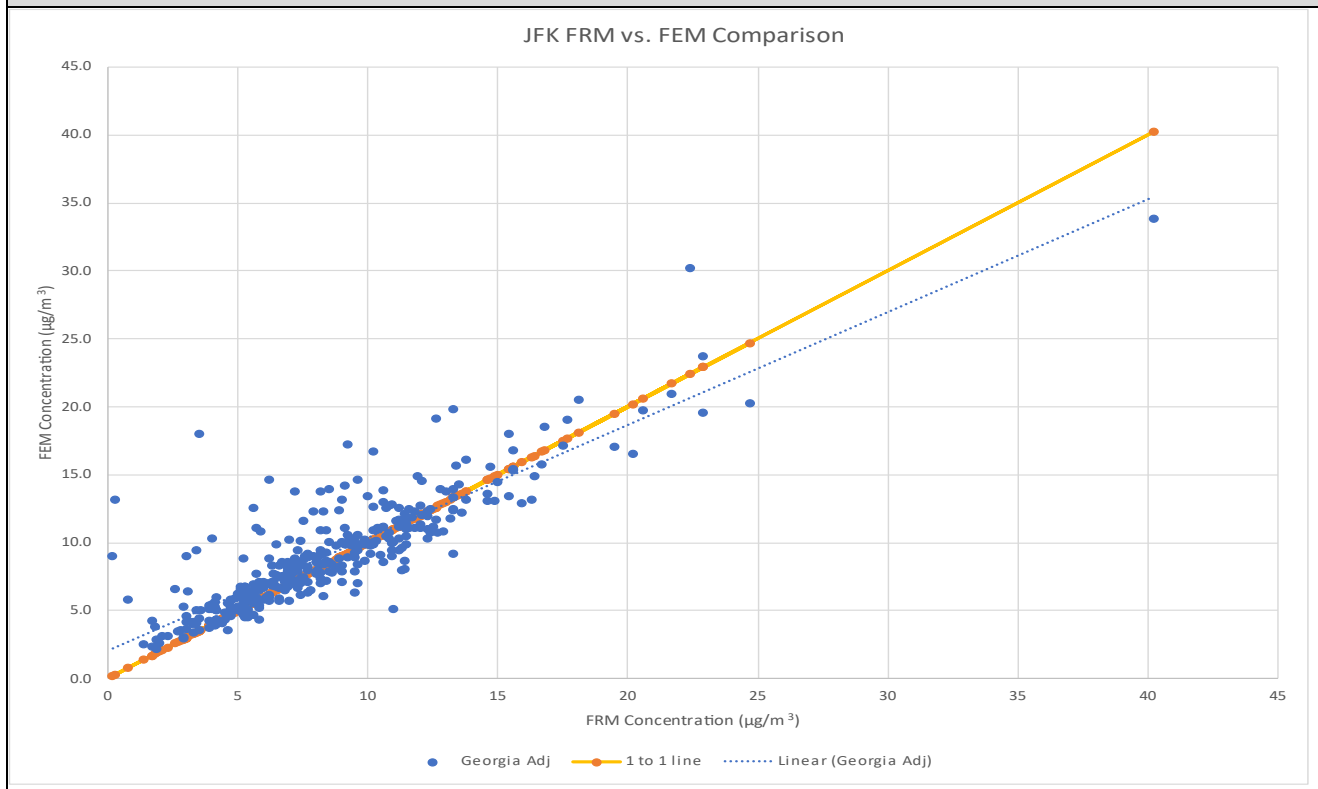
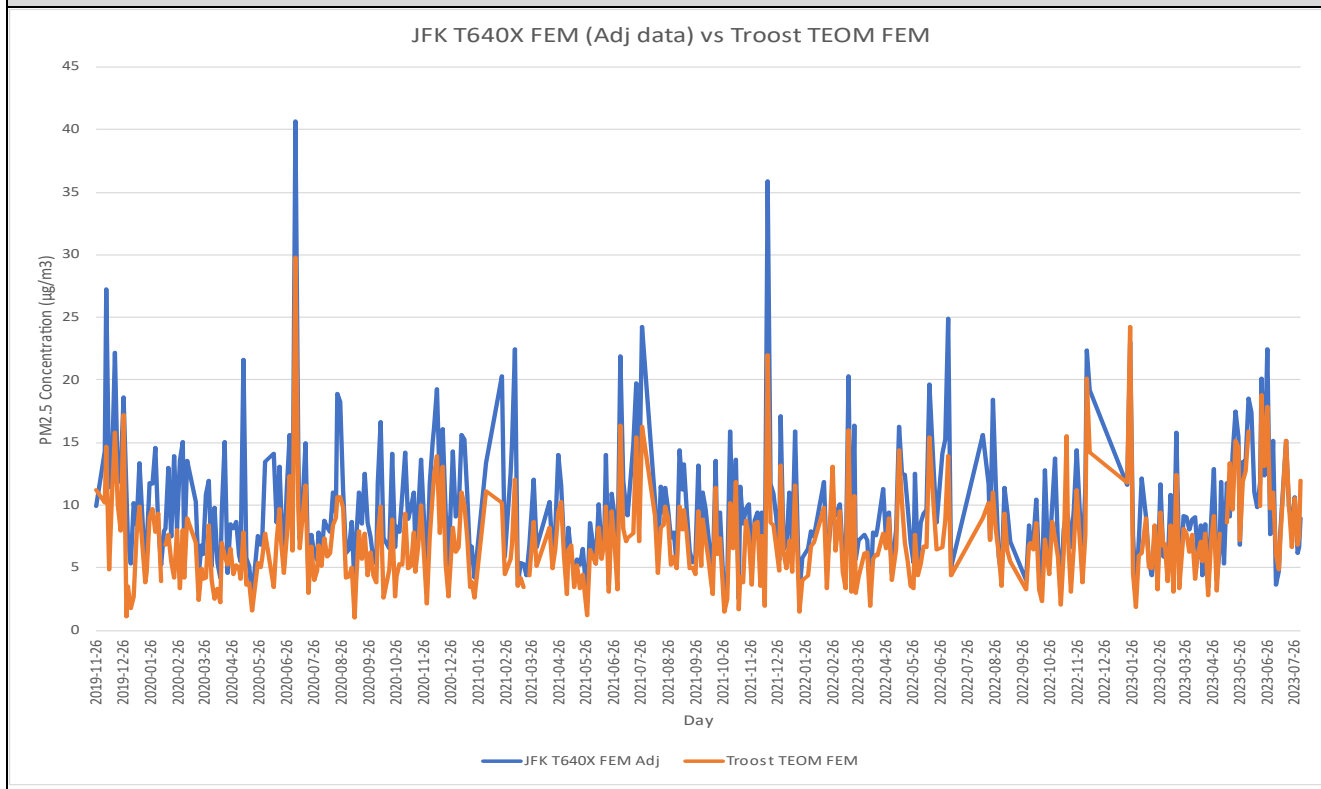


Table 5. Normalized Mean Bias at JFK Monitor

Site Name	Unadjusted FEM	EPA Adjusted FEM (POC 23)	Georgia Adjusted FEM
JFK-KCK (20-209-0021)	32.78%	17.54%	7.98%

The State also compared data from the T640X FEM at JFK to a TEOM-1405-F FEM and T640X run by the State of Missouri Department of Natural Resources Air Pollution Control Program (APCP). This monitor is known as the Troost Air Monitoring Site (29-095-0034) and is in Kansas City, Missouri approximately 3.6 miles east-southeast of the JFK monitoring site in Kansas City, Kansas. The APCP is running the TEOM as a NAAQS monitor and the T640X as a Method Performance Evaluation/Research monitor (Not for NAAQS Compliance Determination). Figure 10 is a comparison of the 24-hour JFK T640X FEM adjusted data versus the Troost TEOM FEM for days when both the T640X and JFK FRM ran from late November 2019 through early August 2023. As can be seen, the JFK T640X FEM was

Figure 10. JFK T640X FEM (Adj Data) vs. Troost TEOM FEM



significantly higher during these comparison days over a three-and-a-half-year period. In fact, the overall 24-hour average of the Troost TEOM FEM over this period was 7.17 µg/m³ compared to 9.76 µg/m³ for the T640X FEM (adjusted data) average. Even though APCP does not have a FRM running at the Troost site, a comparison between the Troost site monitors and the JFK FRM were calculated. Figure 11 shows a comparison between the JFK FRM and Troost TEOM FEM concentrations. On average, the TEOM is running slightly below the values of the FRM at JFK as seen on Figure 11. If one looks at a comparison between the T640 FEM and the TEOM FEM at the Troost site, the T640 data on specific days analyzed was significantly higher. Figure 12 shows the specific days of this comparison between these two FEM monitors located at the same location. The average PM_{2.5} concentration for the Troost TEOM over the analyzed days was 7.2 µg/m³ while the Troost T640 (adj) recorded an average concentration of 9.5 µg/m³, a difference of 2.3 µg/m³. A comparison of these average values to the T640X and the FRM at JFK shows the T640X recorded an average value of 9.76 µg/m³, very similar to the T640 at the Troost Monitor. The JFK FRM recorded an average value of 8.2 µg/m³ during this time frame. In short, both the Kansas and Missouri T640(X) monitors are still recording significantly higher values than the Troost TEOM FEM and the JFK FRM even after being adjusted by Teledyne and EPA.

In a recent study, *Evaluation of Fine Particulate Matter (PM_{2.5}) Concentrations Measured by Collocated Federal Reference Method and Federal Equivalent Method Monitors in the U.S.*⁷, the authors investigated

⁷ Atmosphere 2024, 15(8), 978, 15 August 2024, Tanvir R. Khan, Zachery I. Emerson, Karen H. Mentz

Figure 11. JFK FRM vs. Troost TEOM FEM

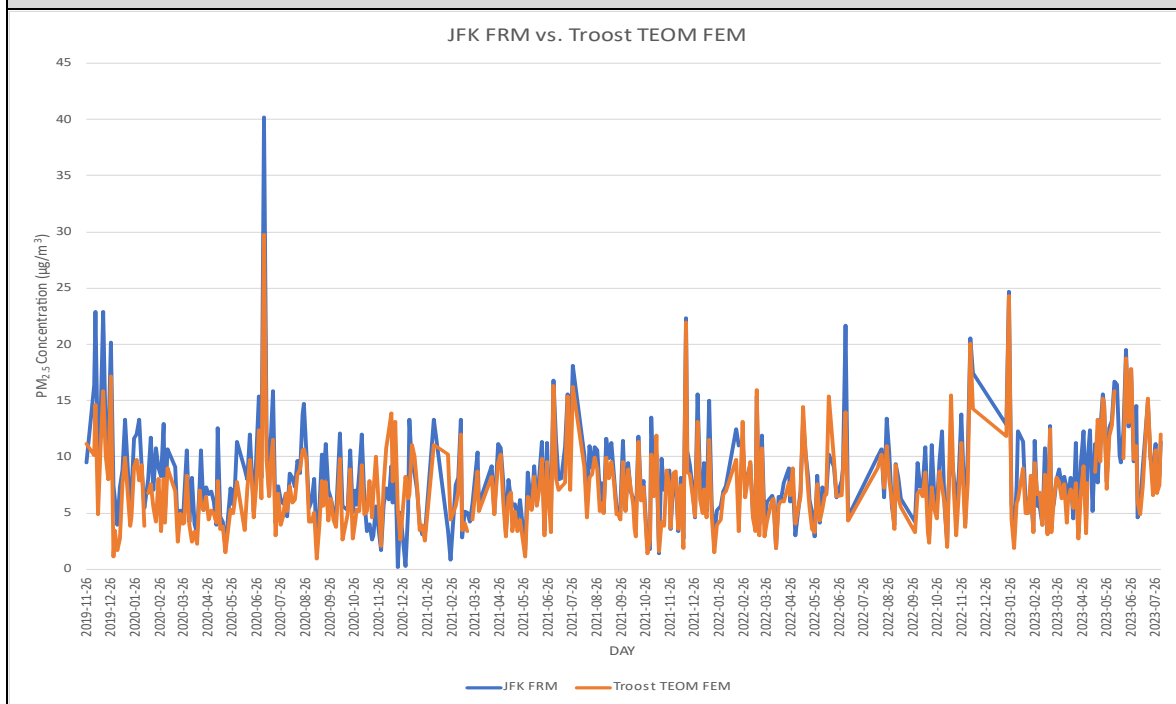
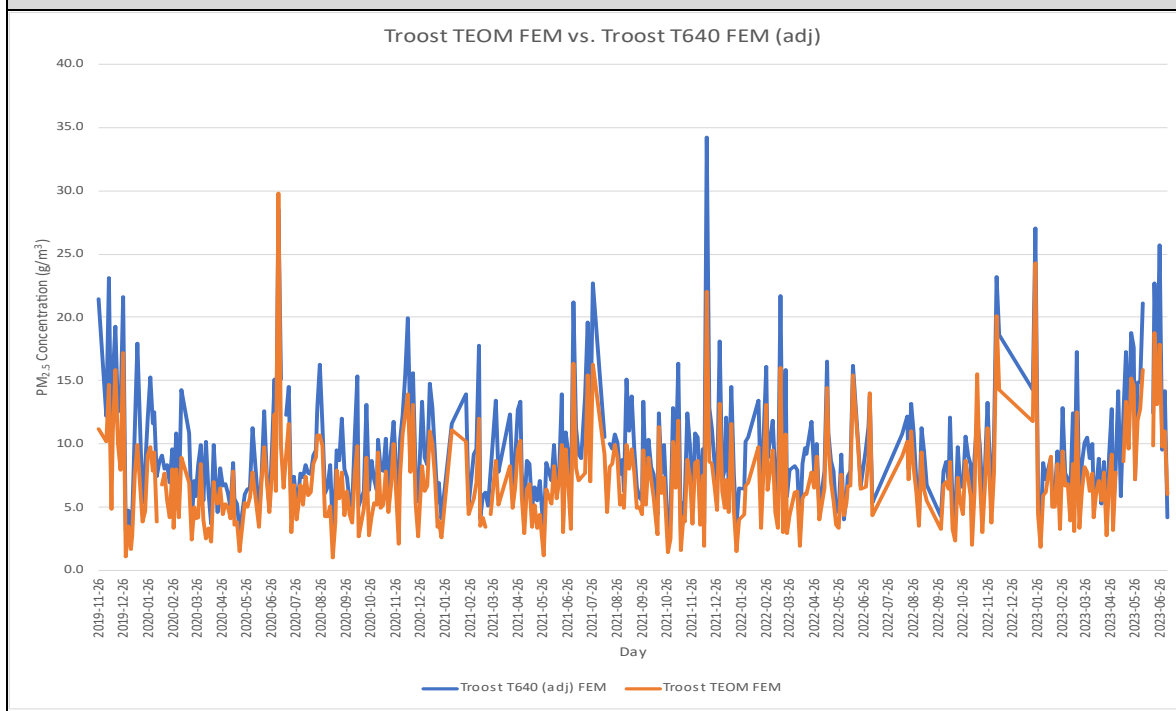
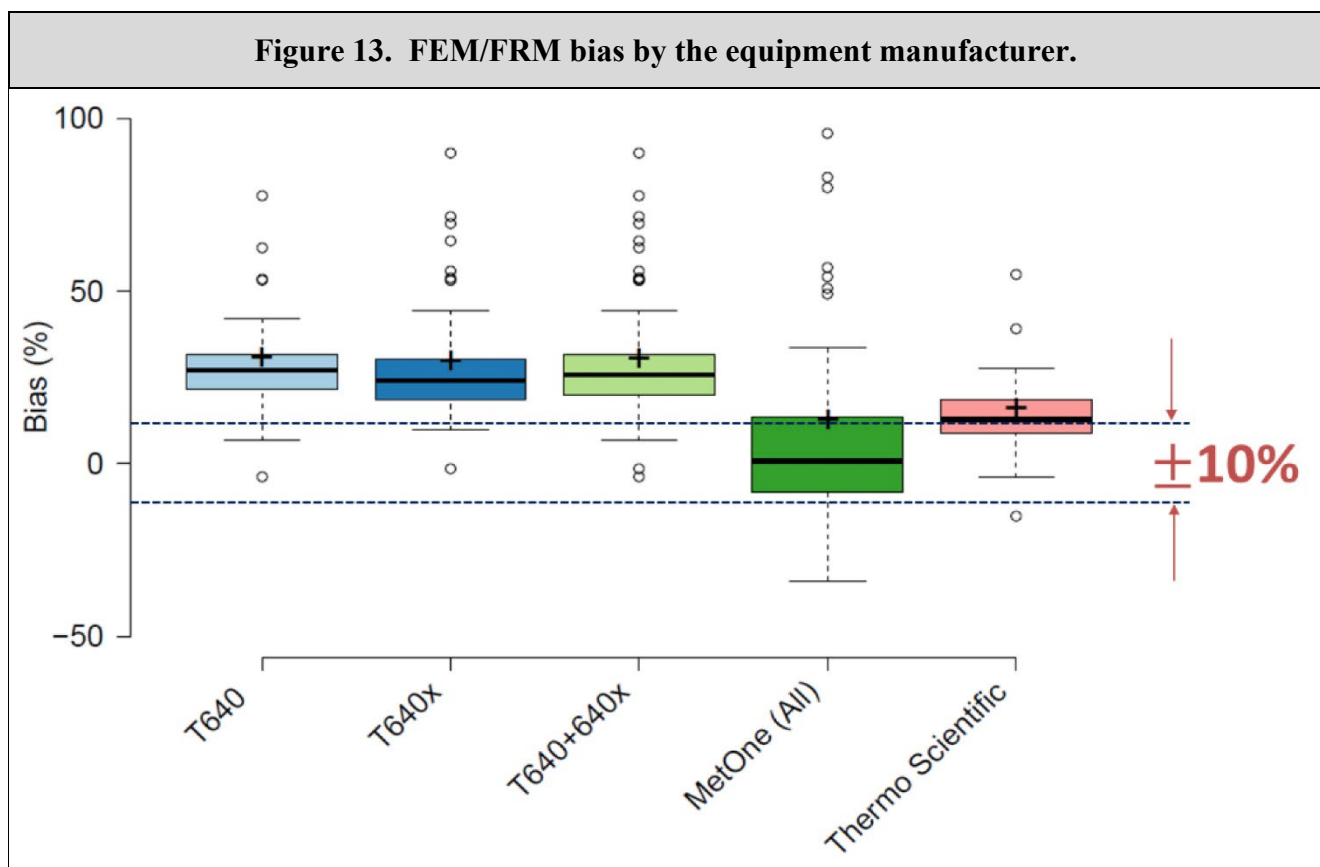


Figure 12. Troost TEOM FEM (NAAQS) vs. Troost T640 (adj) FEM

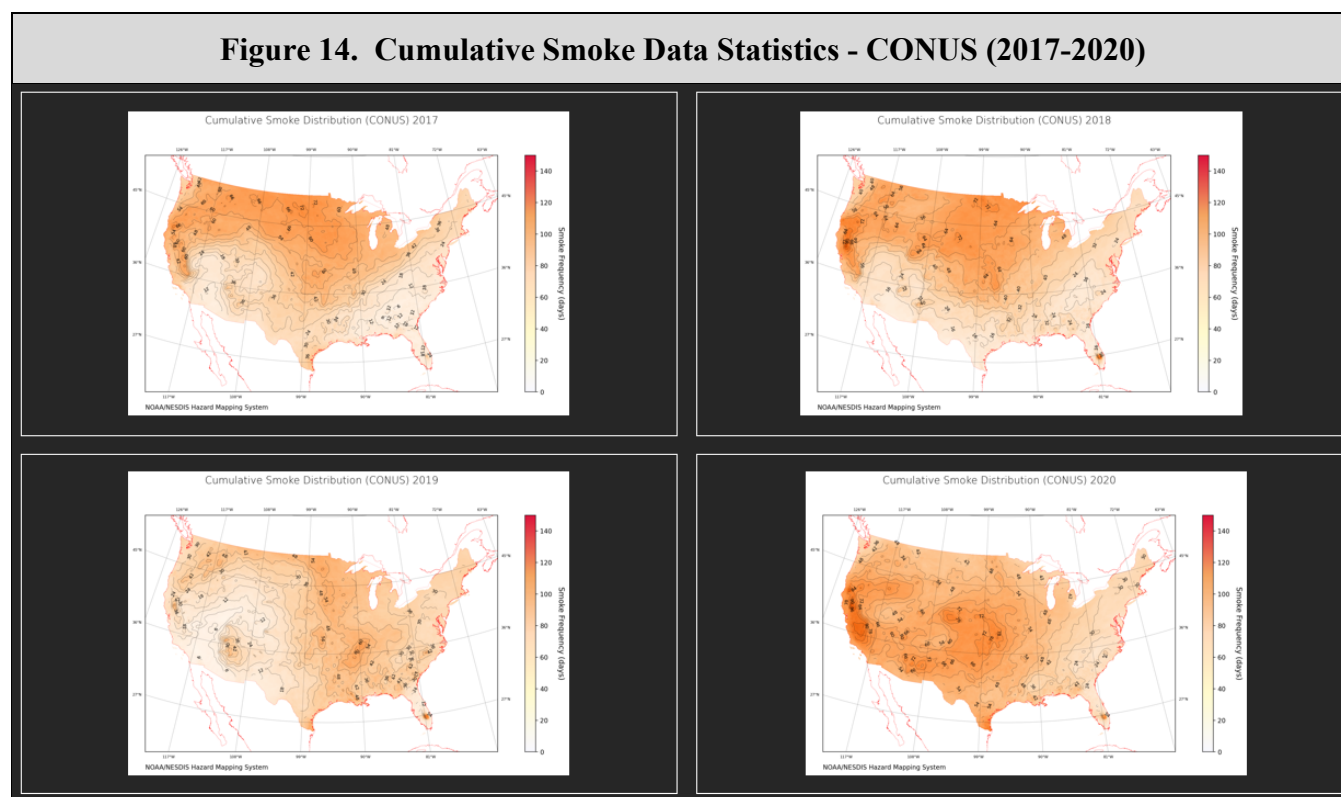


the performance of continuous FEM monitors collocated with FRM monitors across 10 EPA regions in the U.S., focusing on PM_{2.5} measurements collected from 276 monitoring stations. The findings of this study verify the State’s concerns of the T640(X) FEM. It found: “On average, light scatter-based FEM monitors demonstrate higher biases compared to beta attenuation monitors across all EPA regions (28% vs. 12%). Irrespective of the measurement method employed, FEM monitors demonstrate a significant positive bias (mean bias 22%) relative to FRM monitors, which could result in an overestimation of PM_{2.5} design values (DVs) by 13–21% at monitoring sites designating FEMs as primary monitors for NAAQS compliance designations. These findings emphasize the critical need to address method comparability issues, especially considering the recent tightening of NAAQS for PM_{2.5} (annual) from 12 µg/m³ to 9 µg/m³ in the U.S.” Figure 13 displays their bias results categorized by equipment manufacturer and model type, comparing biases against the ±10% range, a data quality criterion recommended by the EPA for comparing PM_{2.5} concentrations from collocated FEM and FRM monitors.



Kansas is an agricultural state where prescribed fire is used extensively. Prescribed fire or prescribed burning season in Kansas begins late February and continues through mid-April. Kansas is a fire adapted landscape. Prescribed fire, at a frequency of 3 to 5 years, plays a critical role in maintaining our grassland’s health and reducing wildfire risk. Prescribed fire reduces fuel loading, controls unwanted trees and brush, increases forage value, and rejuvenates our grasslands. It is tool landowners and land managers use to ensure our valuable grasslands remain intact. As one might expect, Kansas’ airshed is exposed to many days of smoke that might impact air quality monitors across the state. In fact, whether from prescribed fires or the dramatic recent increase in wildfires, especially in Canada, the number of days that Kansas may have impacts from smoke have increased dramatically in the last four years. Figure 14 shows images from the Hazard Mapping System Fire and Smoke Product, produced by the National Oceanic and Atmospheric Administration’s Office of Satellite and Product Operations. Cumulative smoke data annual statistics for 2017–2020 are derived by aggregating daily Hazard Mapping System (HMS) smoke polygons into a 0.05° grid and counting the number of days when individual cells were covered by either light, medium or heavy smoke during the year. Examining these

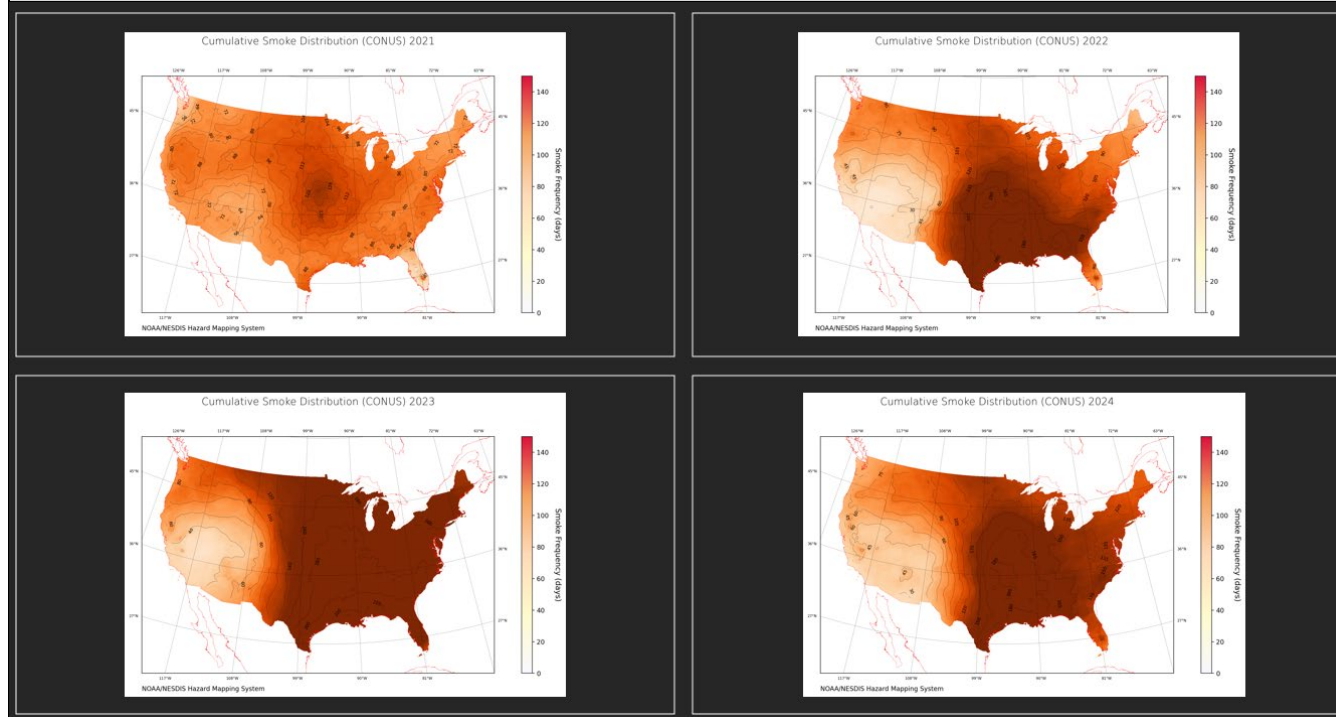
Figure 14. Cumulative Smoke Data Statistics - CONUS (2017-2020)



images, Kansas was covered in some degree of smoke on an average of 40–60 days per year from 2017 to 2019. In 2020, that annual average increased to between 50–70 days of smoke coverage across the state. Figure 15 displays images of HMS cumulative smoke data annual statistics for 2021–2024. As is very apparent, the number of days that smoke was analyzed over the State of Kansas increased dramatically over this four-year period. In 2021, Kansas averaged between 120–130 days of smoke coverage, or about double the number of days seen in the prior four years. In the years 2021 to 2024,

that number of days increased to between 160–200 days per year of some level of intensity of smoke in the atmosphere of the state.

Figure 15. Cumulative Smoke Data Statistics - CONUS (2021-2024)



With all these smoke days, the State is very concerned that areas of the state are going to be potentially deemed in violation of the new annual PM_{2.5} standard based on an instrument that is continuing to run higher than FRM monitors, and was not properly adjusted for its high smoke bias. Recall that EPA and others have noted this high bias of the T640(X) monitor from burning of biomass since its deployment across the country.^{8,9}

As mentioned earlier, the only Kansas site that has both a T640X and FRM monitor located together is the JFK location in Kansas City, KS. The State chose a particular wildfire smoke impacted episode in Kansas City to examine the smoke bias in the T640X. The 2023 Canadian wildfires were well documented¹⁰ and impacted much of the geography of North America, including much of the United States and Kansas. Wildland fire experts have described Canada's 2023 fire season as record-breaking and shocking.¹¹ Over the course of a fire season that started very early¹² and ended late, blazes burned an estimated 18.4 million hectares¹³ (71,043 square miles). For perspective, the size of the State of

⁸ Long, R.; Urbanski, S.; Lincoln, E.; Colón, M.; Kaushik, S.; Krug, J.; Vanderpool R.; Landis, M.: Summary of PM_{2.5} measurement artifacts associated with the Teledyne T640 PM Mass Monitor under controlled chamber experimental conditions using polydisperse ammonium sulfate aerosols and biomass smoke, *Journal of the Air & Waste Management Association*, 73(4), 295-312, 2023.

⁹ https://www.4cleanair.org/wp-content/uploads/Iowa_Wildfire_Smoke_Episode.pdf

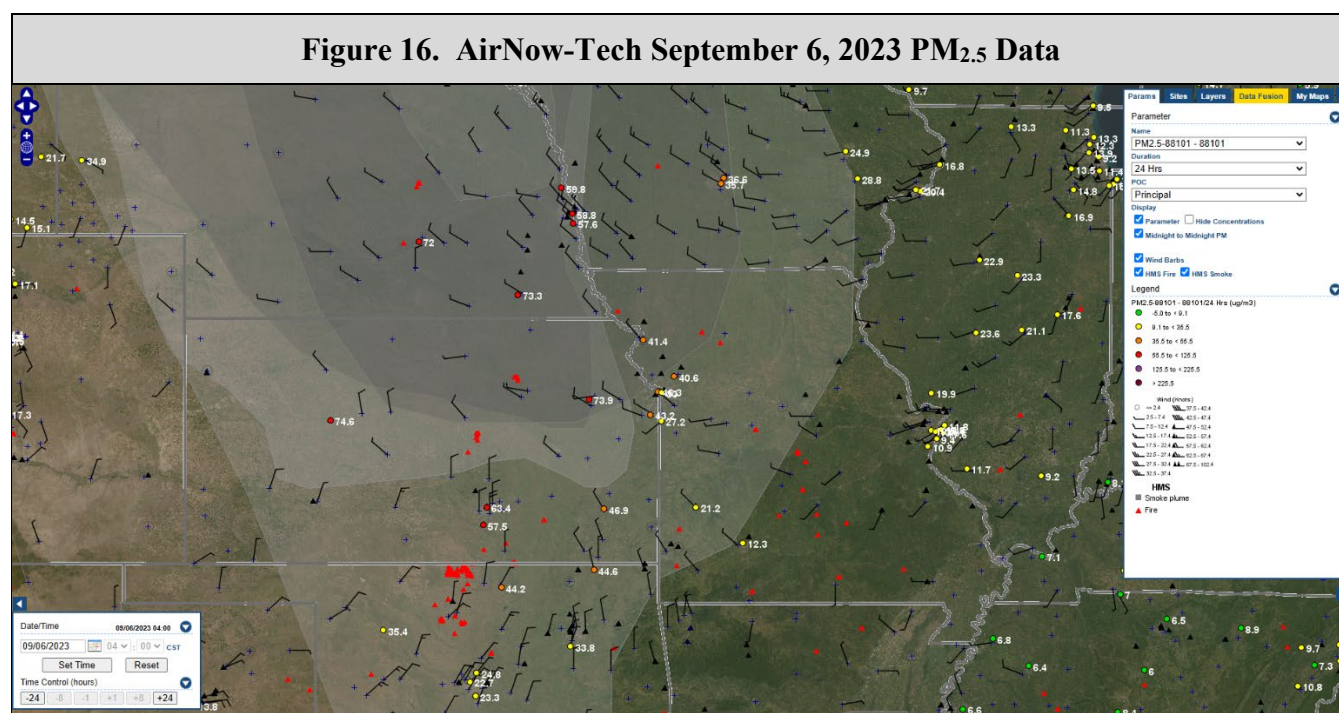
¹⁰ <https://ciffc.net/situation/archive/>

¹¹ <https://natural-resources.canada.ca/simply-science/canadas-record-breaking-wildfires-2023-fiery-wake-call/25303>

¹² <https://www.cnn.com/2023/06/10/us/canada-wildfire-season-us-impact-climate/index.html>

¹³ <https://earthobservatory.nasa.gov/images/151985/tracking-canadas-extreme-2023-fire-season>

Kansas is 82,278 square miles. On average, just 2.5 million hectares¹³ (9,653 square miles) burn in Canada annually. The total area that burned in 2023 amounted to 2½ times the previous record set in 1995 and more than six times the average over the past 10 years.¹⁴ The episode chosen occurred from September 6–8, 2023, across the Kansas City metropolitan area as moderate to heavy smoke from wildfires in Canada was transported into the area on moderate northwest winds.¹⁵ Figures 16–17 show a regional view of the Midwest and a close up of the Kansas City metropolitan area from EPA’s AirNow-Tech with 24-hour PM_{2.5} concentrations, wind barbs, and analyzed smoke plumes across the region from September 6, 2023. AirNow-Tech is a password-protected website for air quality data management analysis and decision support. AirNow-Tech is primarily used by the federal, State, Tribal, and local air quality organizations that provide data and forecasts to the AirNow system, as well as researchers and other air data users. On September 6, moderate to heavy wildfire smoke was pushing across north

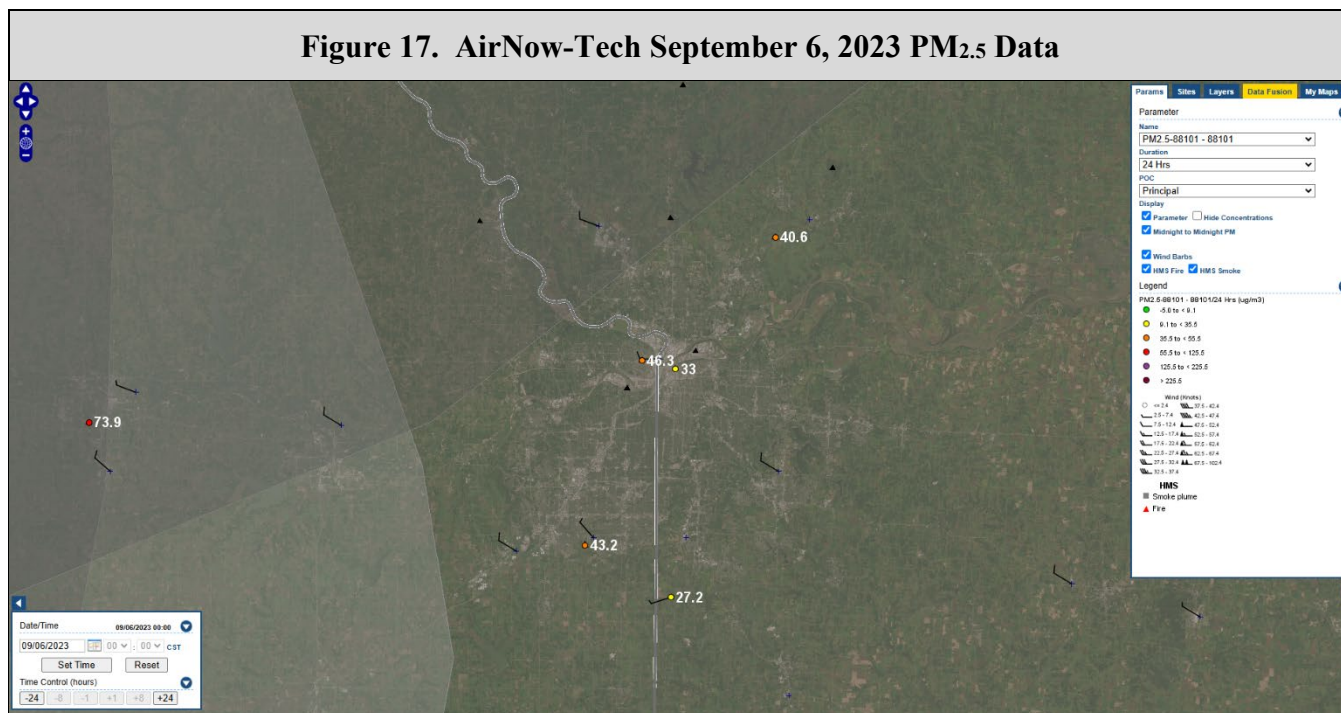


central and northeast Kansas toward the Kansas City metropolitan area. In the zoomed view (Figure 17), the T640X monitor in Topeka, KS recorded a 24-Hour PM_{2.5} concentration of 73.9 µg/m³ (in heavy smoke); the T640X at Heritage Park (Johnson County, KS) had a value of 43.2 µg/m³; and the JFK (Kansas City, KS) T640X recorded a 24-hour value of 46.3 µg/m³. In contrast, the Troost TEOM FEM approximately 3.6 miles across the state line in Missouri recorded a 24-hour value of 33 µg/m³—13.3 µg/m³ less than the T640X in similar smoke conditions. Figures 18–19 show a regional view of the Midwest and a close-up of the Kansas City metropolitan area from EPA’s AirNow-Tech with 24-hour PM_{2.5} concentrations, wind barbs, and analyzed smoke plumes across the region from September 7, 2023. Heavy smoke had reached across almost all eastern Kansas and had moved into southeast Missouri. Moderate smoke was continuing to impact far eastern Kansas and western Missouri, including the Kansas City metropolitan area. In the zoomed view (Figure 19), the T640X monitor in Topeka, KS

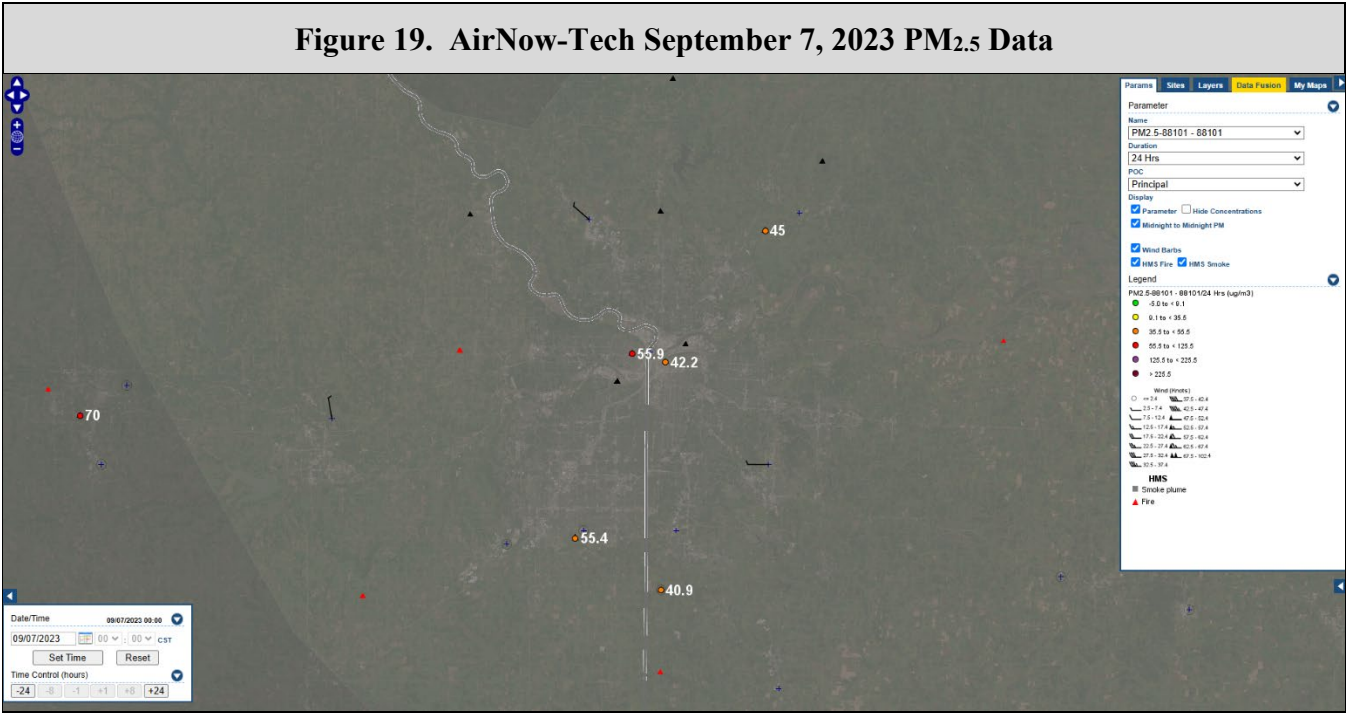
¹⁴ <https://www.cbc.ca/news/climate/wildfire-season-2023-wrap-1.6999005>

¹⁵ <https://www.kshb.com/news/local-news/hazy-conditions-smell-of-smoke-envelop-kansas-city-wednesday-afternoon#:~:text=KANSAS%20CITY%2C%20Mo.,and%20the%20Truman%20Sports%20Complex.&text=Smoke%20over%20the%20Truman%20Sports%20Complex%20on%20Sept.>

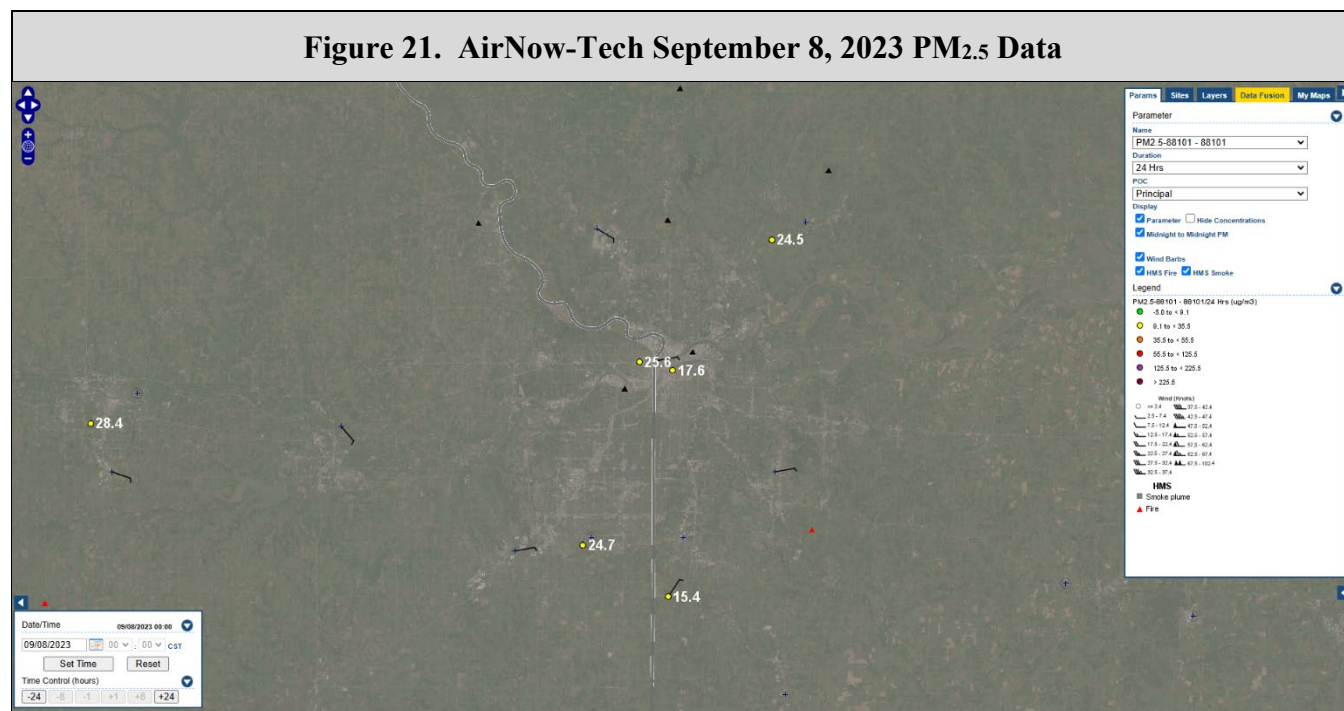
Figure 17. AirNow-Tech September 6, 2023 PM_{2.5} Data



similar smoke conditions. Additionally, the T640X at Heritage Park (Johnson County, KS) recorded a value of 55.4 $\mu\text{g}/\text{m}^3$ while the Richards-Gebaur South TEOM FEM in Missouri recorded a value of 40.9 $\mu\text{g}/\text{m}^3$, 14.5 $\mu\text{g}/\text{m}^3$ less. This site is located approximately 10 miles southeast of the Heritage Park monitor site in Johnson County, Kansas.



Figures 20–21 show a regional view of the Midwest and a close-up of the Kansas City metropolitan area from EPA’s AirNow-Tech with 24-hour PM_{2.5} concentrations, wind barbs, and analyzed smoke plumes across the region from September 8, 2023. On this day, the smoke intrusion episode had begun to lighten up across the Midwest as the heaviest smoke had retreated to western Iowa and a small section of northwest Missouri. The Kansas City metropolitan area had seen a decrease in smoke intensity from the previous two days but lighter smoke still blanketed the area. In the zoomed view (Figure 21), the T640X monitor in Topeka, KS recorded a 24-Hour PM_{2.5} concentration of 28.4 µg/m³, the T640X at Heritage Park (Johnson County, KS) had a value of 24.7 µg/m³, and the JFK (Kansas City, KS) T640X recorded a 24-hour value of 25.6 µg/m³. Even in lighter smoke, the Troost TEOM FEM continued to be less than the T640X at JFK. The Troost TEOM FEM recorded a value of 17.6 µg/m³, 8 µg/m³ less than the T640X.



The State believes that this example continues to show that the T640X is biased high in smoke events, not only in Kansas but across the country. Concentration differences in this three-day wildfire smoke event between the T640X and a TEOM FEM located 3 miles away ranged from 8 µg/m³ to 13.7 µg/m³.

Per Section 107 of the Clean Air Act, areas should also be designated nonattainment if they contribute to ambient air quality in a nearby area that does not meet the national ambient air quality standard. To determine if sources in Kansas contribute to violations in nearby areas outside of the state, data from PM_{2.5} monitors located within 50 km of the Kansas border were also evaluated. Four monitors located in Missouri fall within the 50 km range (see Figure 23). None of these monitors have design values in violation of the 2024 Primary Annual PM_{2.5} NAAQS (see Table 6); therefore, no further evaluation was conducted.

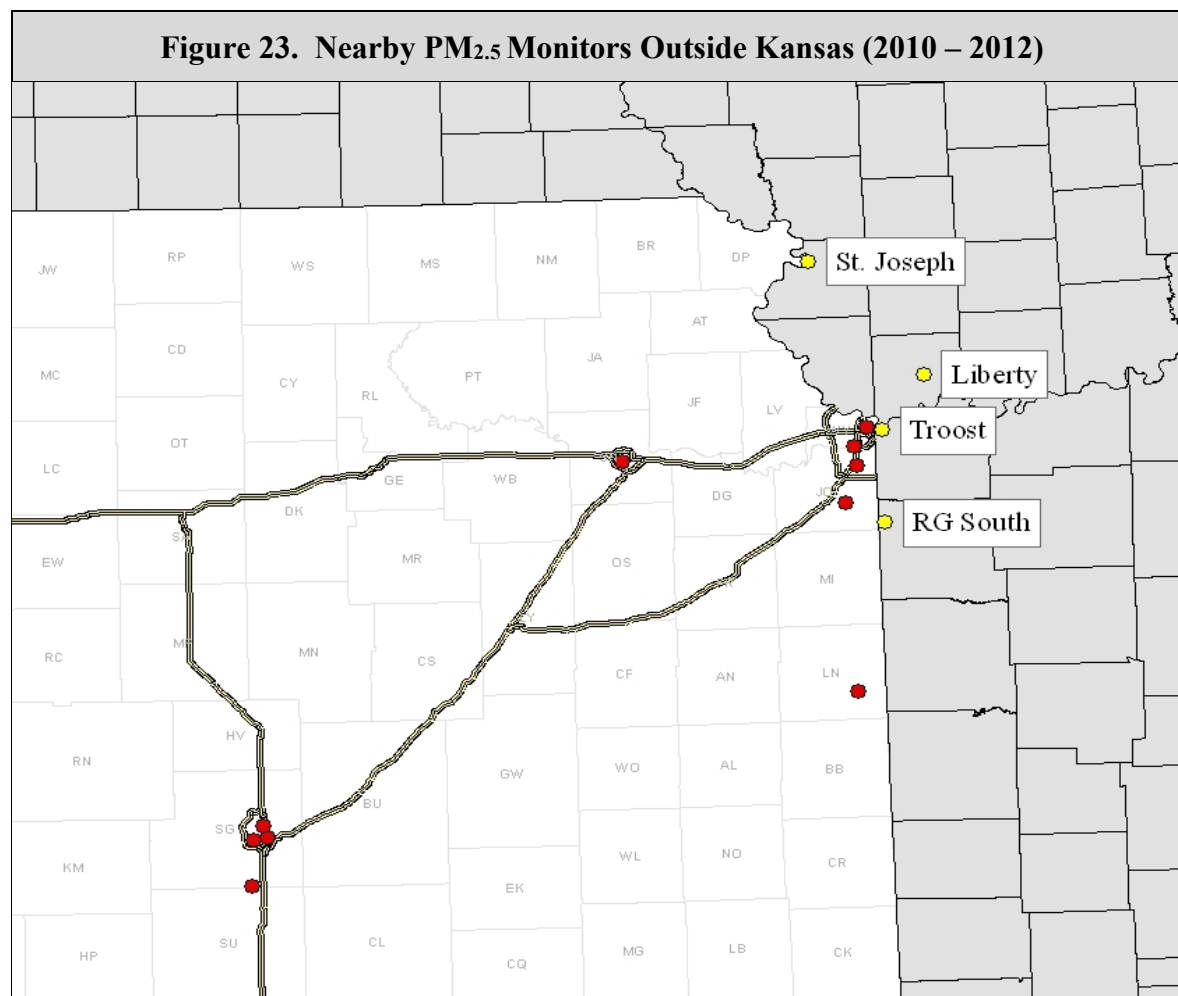


Table 6. Nearby PM _{2.5} Monitor Design Values (2021 – 2023)			
Site Name	AQS Site ID	County	2021 – 2023 Annual PM _{2.5} Design Value (µg/m ³)
St. Joseph Pump Station	29-021-0005	Buchanan	8.6
Liberty	29-047-0005	Clay	6.0
Troost	29-095-0034	Jackson	7.6
RG-South	29-037-0003	Cass	6.3*

*- Did not meet data completeness requirements

Conclusion:

As discussed throughout this document, the State of Kansas believes that there continues to be issues with the T640(X) and its data compared to FRM data. Even though the Teledyne/EPA data algorithm improved the bias in the monitored data from the T640X, there continues to be issues with high biases as compared to both the FRMs and other FEMs. In addition, there is ample evidence from research and example used in this document, where the T640(X) clearly shows a high bias when exposed to wildfire and/or prescribed fire smoke. As far as the State can discern, no attempt was made by Teledyne or EPA to mitigate this high smoke bias in this instrument when the data was corrected or implemented in the firmware update provided by Teledyne. Many other states continue to voice their concerns about the use of the T640(X) FEM data to determine meeting or not meeting the new annual PM_{2.5} standard. North Dakota voiced their concerns in their draft 2023 Canadian Wildfire Exceptional Event document located here: https://deq.nd.gov/AQ/Notices/EE/2023CanadianWildfireEEDemonstration_DRAFT.pdf.

“While the alignment algorithm resulted in an improvement in the T460/T640X FEM monitor bias compared to FRM monitors, it still does not adequately reduce the bias in the PM_{2.5} concentrations. In fact, the bias is so significant that, for the new 2024 PM_{2.5} Annual NAAQS the ongoing bias could lead to an area being improperly designated nonattainment based on T640/T640X FEM monitored data while the area would have been designated attainment based on FRM monitored concentrations.”

In addition, on December 20th, the Association of Air Pollution Control Agencies (AAPCA)¹⁶ sent a letter to the EPA Administrator and Teledyne’s Chief Executive Officer voicing their continued concerns over the use of the T640(X) in NAAQS determinations:

“AAPCA’s state and local air agency members are concerned that the Teledyne T640/X FEM instruments have a significantly high bias compared to FRM instruments. AAPCA appreciates Teledyne Technologies and U.S. EPA’s efforts to correct the bias in the Teledyne T640/X FEM. However, the bias adjustment algorithm that was developed by Teledyne, approved by U.S. EPA, and applied to AQS data does not adequately reduce the bias in the Teledyne T640/X PM_{2.5} concentrations, resulting in annual PM_{2.5} concentrations that are significantly higher compared to annual PM_{2.5} concentrations measured with FRM monitors. This can lead to areas being designated nonattainment based on measured Teledyne T640/X PM_{2.5} concentrations, when the area would have been designated attainment based on measured FRM PM_{2.5} concentrations. As a result, many state and local air monitoring programs are in the process of invalidating the Teledyne T640/X measurements and moving away from the Teledyne T640/X instruments.”

The State of Kansas recommends that the three monitors (T640Xs) located in Neosho County (Chanute), Sedgwick County (Wichita HD) and Wyandotte County (JFK) that currently do not meet the new primary annual standard of 9.0 µg/m³ be designated “Unclassifiable” for the new standard, based on the continued concerns by many states over the data being produced by the T640(X) and the analysis provided in this document. It would be improper to penalize a state, its citizens and businesses based on a flawed monitor. The State would also propose that it is currently moving forward with purchasing two

¹⁶ AAPCA is a national, non-profit, consensus-driven organization focused on assisting state and local air quality agencies and personnel with implementation and technical issues associated with the federal Clean Air Act. Created in 2012, AAPCA represents 53 state and local air pollution control agencies, and senior officials from 21 state environmental agencies currently sit on the AAPCA Board of Directors. AAPCA is housed in Lexington, Kentucky as an affiliate of The Council of State Governments. More about AAPCA is at: www.cleanairact.org.

additional FRM monitors to install at the Chanute and Wichita HD monitor sites to collocate next to the existing T640X monitors. These installations will allow the State to run these monitors side by side to determine what the proper design value is for each location, and work to develop what a data alignment algorithm for the State of Kansas should be for the T640X.

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January 28, 2025

Kansas Department of Health and Environment
Bureau of Air
1000 S.W. Jackson, Suite 310
Topeka, Kansas 66612-13666

Re: Kansas PM2.5 NAAQS Designation Recommendations

Dear Mr. Doug Watson:

The Mid-America Regional Council (MARC) Air Quality Forum (AQF), created in accordance with Section 174 of the Clean Air Act to coordinate the development and implementation of air quality policy in the bi-state Kansas City region, offers the following comments on the KDHE's proposed recommendation for PM2.5 NAAQS Designations:

KDHE utilizes the Federal Equivalent Monitor (FEM) Teledyne T640X monitor rather than the filter based Federal Reference Monitors (FRM). It has been documented and recognized that this monitor has a pronounced high bias, and the EPA has retroactively applied Network Data Alignment equations to adjust the T640x data using temperature and concentration. KDHE has concluded however that this procedure is insufficient to account for the high bias, particularly when PM2.5 is related to smoke from wildfires and/or controlled burns. Monitor data and design values from 2021-2023 indicate that three Kansas counties, including Wyandotte County, have design values that exceed the annual PM2.5 National Ambient Air Quality Standards (NAAQS). However, until the remaining T640x high bias has been resolved, KDHE feels making an attainment designation should not be based on existing data from these monitors.

In their more detailed analysis of the monitor in Wyandotte County, KDHE presented a comparison with data collected at the Troost Air Quality Monitoring Site in Missouri (3.4 mile south-southeast). Data demonstrated that the T640x in Wyandotte County had significantly higher readings than the TEOM FEM at Troost, even after applying the Network Data Alignment to the T640x. A collocated secondary T640 FEM monitor at Troost also showed high bias compared to the site's main TEOM FEM and was instead similar to the data from Wyandotte County.

The Missouri Department of Natural Resources looked at speciation data to rule out the possibility that the Wyandotte County T640x FEM was higher due to hyperlocal sources of particulate matter originating in Missouri. MDNR concluded that the higher design value in Wyandotte County is not due to hyperlocal sources and that the most likely cause is ongoing unexplained positive bias of the Teledyne T640X and T640 monitors.

The AQF agrees with KDHE's recommendation to designate Wyandotte County as 'Unclassifiable.' The AQF has reviewed KDHE's analysis of the bias issue that led to their conclusion and shares their concern. The Forum further recognizes that the bias associated with the T640X monitors is a continued concern among many air pollution control agencies and the Association of Air Pollution Control Agencies.

Wyandotte County's design value for PM2.5 (2021-2023) at $9.6 \mu\text{g}/\text{m}^3$ is very close to the $9.0 \mu\text{g}/\text{m}^3$ federal standard. Considering the increase in smoke days due to sources outside the region over the last few years and the uncorrected high

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Executive Director
David A. Warm

bias associated specifically with smoke, the Forum similarly concludes that increased attention to the apparent bias of the T640X FEMs is required and the remaining bias should be remedied prior to any attainment designation for Wyandotte County. Additionally, the AQF agrees with KDHE's recommendation that the agency purchase and install FRMs at the Chanute and Wichita monitor sites and work to develop a data alignment algorithm for the State of Kansas' T640X.

The MARC Board of Directors, which consists of 33 local elected officials from the Kansas City region, has endorsed the Air Quality Forum's position on the proposed PM2.5 NAAQS designation recommendation. Thank you for this opportunity to comment. Please contact Karen Clawson, MARC Air Quality Program Manager at 816-701-8255 or kclawson@marc.org if you have any questions.

Sincerely,



Andy Savastino, City of Kansas City, Mo.
Office of Environmental Quality
Co-Chair, Air Quality Forum



Rollin Sachs, Johnson County, Ks.
Department of Health and Environment
Co-Chair, Air Quality Forum