

Supplemental Information on the EPA's Update of PM_{2.5} Data from T640/T640X PM Mass Monitors

May 13, 2024

OVERVIEW

In April 2023, under the Reference and Equivalent Method Program at 40 CFR 53.14, the Environmental Protection Agency (EPA) approved a modification of the Federal Equivalent Method (FEM) designation for the Teledyne Advanced Pollution Instrumentation (TAPI) Model T640 PM mass monitor, including the 640X option (hereto T640 and T640X), 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.^{1,2} Subsequently, TAPI developed a Network Data Alignment utilizing a robust national dataset from routinely operated collocated PM_{2.5} FRMs and T640 and T640X FEMs. The EPA has determined that this Network Data Alignment has resulted in a much higher number of PM_{2.5} monitoring sites using these methods meeting the bias measurement quality objectives (MQOs) found at 40 CFR part 58, Appendix A, section 2.3.1.1.

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. The Network Data Alignment is also applicable to PM₁₀ measurements moving forward; however, the EPA believes there is a diminutive effect on PM₁₀ data relative to its data uses. Therefore, the EPA is prioritizing the Network Data Alignment for PM_{2.5} but anticipates working with air agencies to implement the Network Data Alignment for PM₁₀ in the future. This document provides background on the EPA's approval of the T640 and T640X monitors, the action EPA is taking to ensure the most accurate PM_{2.5} data are available for the EPA and all stakeholders, and the potential implications of this action on future EPA actions.

BACKGROUND

The TAPI Model T640 PM mass monitor (T640) and TAPI Model T640 with 640X option (T640X) were each approved as FEMs for PM_{2.5} by the EPA's Reference and Equivalency Program and announced in the *Federal Register* on July 13, 2016 (81 FR 45285). By early 2017, the state monitoring agencies began operating T640 and T640X PM FEMs in their networks and

¹ 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.

² 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.

reporting data to EPA's 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 1).

Early adopters of the T640 and T640X PM_{2.5} FEMs provided largely positive feedback on the methods, reporting advantages including less maintenance and the use of fewer consumables, highly precise data, availability of high time-resolution data, and 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}). However, from early in the adoption of the methods, monitoring agencies reported a positive bias resulting in higher PM concentrations relative to collocated FRMs.

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 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 is not as pronounced as the bias data from FRM samplers run by the monitoring agencies. Nevertheless, the network of T640 and T640X PM_{2.5} FEMs continued to grow.

During the scientific review of EPA's Policy Assessment for the Reconsideration of the PM NAAQS two years ago, the Clean Air Scientific Advisory Committee (CASAC) provided advice in a March 18, 2022, letter³ suggesting that, "The FEM bias needs to be addressed to make the FRMs and FEMs more comparable." To support that recommendation, the EPA included in its Notice of Proposed Rulemaking for the Reconsideration of National Ambient Air Quality Standards for Particulate Matter a proposal to calibrate PM FEMs using routinely operated PM FRMs from state, local and Tribal air agencies (SLTs). After notice and comment on the proposed rule, which was widely supported, this part of the proposal was finalized in the recent final rulemaking.⁴ (89 FR 16202, March 6, 2024).

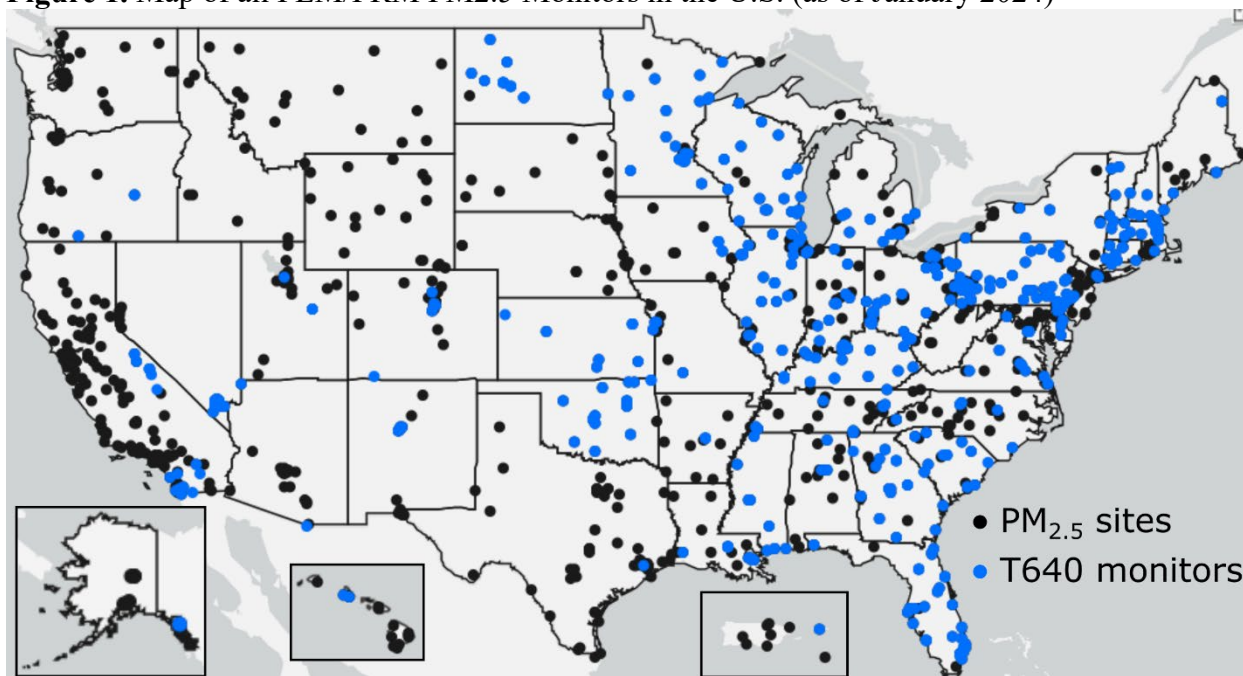
In parallel with the EPA and CASAC dialogue on improving the comparability of PM FRMs and FEMs, TAPI started evaluating the comparability of the FRM and their FEMs operating in routine SLT agency networks. This led to TAPI applying to EPA for a modification to the T640 and T640X PM FEMs to better align their reported concentrations with collocated FRMs. TAPI provided this application under existing rules in 40 CFR 53.14. The modification request was approved by the EPA Office of Research and Development's Reference and Equivalency Program in April 2023. Thereafter, TAPI launched the modification via a firmware update that became available to SLTs in June 2023.

³ EPA-CASAC-22-002, [CASAC Review of the EPA's Policy Assessment for the Reconsideration of the National Ambient Air Quality Standards for Particulate Matter \(External Review Draft – October 2021\)](#), March 18, 2022

⁴ See <https://www.epa.gov/pm-pollution/national-ambient-air-quality-standards-naaqs-pm>.

Within several days of the launch of the update by TAPI, the EPA and SLTs held calls through their stakeholder groups (i.e., National Association of Clean Air Agencies, the Association of Air Pollution Control Agencies, and the National Tribal Air Association) to discuss the availability of the new firmware, recommendations, options for testing the update, and plans to ensure data produced by updated T640 and T640X PM_{2.5} FEMs are clearly identified in EPA's databases, AIRNow and AQS. Nationwide, all primary T640/T640X monitors have transitioned to the updated methods. Informal feedback from SLTs suggests that the updated methods are showing improved comparability with the FRM data for July through December of 2023.

Figure 1. Map of all FEM/FRM PM_{2.5} Monitors in the U.S. (as of January 2024)



UPDATE OF HISTORICAL DATA

The data update EPA implemented has been conducted entirely within AQS on all hourly unaligned T640 and T640X PM_{2.5} concentration data with a Parameter Code of 88101 starting in 2017, when the first TAPI FEMs reported data to AQS. As discussed in more detail below, the unadjusted data as originally collected by the TAPI FEMs and reported by SLTs remain in AQS and will remain publicly available hereafter.

The EPA has taken the following steps to implement the data update in AQS. The data utilizing the updated method has been added automatically to AQS as a new Parameter Occurrence Code (POC) at the site with the same 88101 Parameter Code and a 3-digit numeric AQS Method Code to reflect the fact that it is calculated using the updated FEM designation (736 for the T640 and

738 for the T640X). These 3-digit method codes are consistent with the AQS Transaction Format Guide.⁵ SLTs will not upload the retroactively aligned data to AQS.

To most closely replicate the methodology of the Network Data Alignment equation used in the updated FEM designation for a specific site, the EPA has used the hourly ambient temperature data in AQS associated with the site when available. The hourly ambient temperature data may be measured at the site or from a paired meteorological station in AQS associated with that site. When hourly ambient temperature data are unavailable at the T640/T640X site or paired site, the more conservative warmer temperature correction was be used. Because data updated with the complete correction (including temperature) better meet MQOs than with the conservative correction, SLTs are encouraged to pair T640/T640X sites without ambient temperature data with an AQS site within the same Core-Based Statistical Area (CBSA) or Combined Statistical Area (CSA) that has ambient temperature data. The EPA believes that ambient temperatures within a CBSA/CSA are consistent enough that the Network Data Alignment will be accurately applied to the paired T640/T640X site. SLTs with T640/T640X sites in CBSAs/CSAs without ambient temperature data are encouraged to pair with AQS sites within 50 km that have ambient temperature data following the “urban scale” definition in 40 CFR, part 58, section 1.2(b)(4).

Upon creation of the updated dataset for each site, data from the unaligned monitors have been set to the **Monitor Type “SPM”** and considered “NAAQS Excluded” but retained in AQS. At sites where the unaligned data monitor was designated the Primary Monitor for PM_{2.5}, the Primary Monitor designation has been assigned to the monitor with updated data. Although not required, EPA recommends that SLTs review the updated data by May 28, 2024, and contact their EPA Regional Office with any questions.

SLTs may request to opt-out for any FEM monitor data that they conclude are inappropriate to be updated in this way. An SLT should consider opting out only if the SLT can demonstrate that, for a specific site and for a specific use, the unaligned data would better meet MQOs than the updated data. As such, justification for this opt-out will be evaluated by the EPA on a case-by-case basis and should be based on scientific and technical information and should fully explain the specific purpose for which the SLT wishes to use the unaligned data. This request should be submitted to the appropriate EPA Regional office as a one-time addendum to the Annual Monitoring Network Plan due July 1, 2024.⁶ This addendum is only necessary if the SLT wishes to request an opt-out of this data update for a specific site. The EPA intends to use the updated data in AQS in actions taken after the May 1, 2024, certification date and will work on next steps with SLTs that request to opt-out of the update.

The EPA expects that a small number of monitors may have unaligned T640 or T640X data and/or associated ambient temperature data submitted to AQS after the initial batch update of

⁵ See

<https://aqs.epa.gov/aqsweb/documents/codingmanual/html/fromdatabase/Method%20Code.html?highlight=method%20code>.

⁶ As such, the SLT’s opt-out request will be subject to the same public participation requirements as the Annual Monitoring Network Plan under 40 C.F.R. § 58.10.

retroactive data has been conducted. In these cases, the EPA will ensure these data are processed with the Network Data Alignment automatically.

CONSIDERATIONS

Updated data for the TAPI Model T640 and T640X are important to ensure the EPA considers data that accurately represent ambient air concentrations in our actions. Below are some specific considerations that illustrate the importance of updating the historical data in AQS.

Academics and Research

The EPA believes it is important to update the historical data in AQS to ensure that the most scientifically accurate data are utilized in peer-reviewed research that support the NAAQS, in particularly when evaluating human health and ecosystem activities.

Implementation

The EPA anticipates that the updated data will be relevant to upcoming PM_{2.5} NAAQS implementation-related activities, including any forthcoming initial area designations, any future redesignation actions, and findings of attainment that may rely on monitoring data from the previous 3 to 5 years. The EPA encourages SLTs to work with their EPA Regional offices to address any outstanding needs related to updating historical data and PM_{2.5} implementation.

With respect to any upcoming initial area designations associated with the 2024 PM_{2.5} NAAQS, the EPA expects that this update will impact the ambient monitoring data used for these designations due to the widespread use of the TAPI T640 and T640X monitors, particularly in the eastern U.S. The Clean Air Act requires states to submit, and gives Tribes the opportunity to submit, initial area designation recommendations within 12 months after the EPA has issued a new or revised NAAQS. Regarding ongoing attainment planning, SLTs with areas designated nonattainment under any PM_{2.5} NAAQS will have implementation planning obligations that may be impacted by the updated data. The EPA will consider any regulatory implications (e.g., attainment planning and redesignations to attainment) on a case-by-case basis and encourages SLTs to consult with their EPA Regional office contacts on this topic.

Similarly, regarding exceptional events demonstrations, the EPA anticipates the affected and adjusted T640 and T640X monitors also may have experienced event-influenced exceedances/violations. These data update may impact exceptional events demonstrations associated with any initial area designations process, or any other action of regulatory significance regarding the PM_{2.5} NAAQS. For this reason, the EPA encourages SLTs to work with their EPA Regional offices to determine a path forward on the updated data and the associated impact on any upcoming exceptional events demonstrations.

Permitting

The EPA recognizes that the retroactively data update will impact prevention of significant deterioration (PSD) permit applicants that require historical ambient PM_{2.5} data to develop background concentrations for NAAQS and PSD increment compliance demonstrations. The retroactive data update will include the 5-year period required for these demonstrations. The

EPA intends to use the same retroactively updated ambient data to develop new PM_{2.5} Significant Impact Levels (SILs) that will be provided in upcoming supplemental guidance.