

MASS CONCENTRATION COMPARISON BETWEEN THE DUSTTRAK™ DRX AEROSOL MONITOR AND TEOM

APPLICATION NOTE EXPMN-004 (A4)

This application note compares the performance of the DUSTTRAK DRX Aerosol Monitor in real time with a Tapered Element Oscillating Microbalance (TEOM). Arizona Road Dust (ISO 12103-1, A1 test Dust) was generated using the TSI Fluidized Bed Aerosol Generator (Model 3400A). A mixing chamber was used to distribute the aerosol from the fluidized bed to all the sampling instruments including the DUSTTRAK DRX Aerosol Monitor and the TEOM. Concentration was changed by changing the output of the fluidized bed and the dilution air flow rate.

Figures 1a, 1b, and 1c are plots of time series of mass concentrations measured by the DUSTTRAK DRX Aerosol Monitor. Since the DUSTTRAK DRX Aerosol Monitor is capable of measuring simultaneously, the PM₁, PM_{2.5}, Respirable, PM₁₀, and TPM fractions of the sampled aerosol, all of them are plotted on the sample graph. These measured mass concentrations were compared with the TEOM. Each graph is a comparison of the DUSTTRAK DRX Aerosol Monitor with TEOM fitted with a specific size-selective inlet. Figure 1a is a comparison with TEOM fitted with a PM₁₀ impactor, Figure 1b is with the TEOM with a Respirable impactor, and Figure 1c is with a TEOM with a PM_{2.5} impactor. These graphs (figures) show that each size segregated mass channel measured by the DUSTTRAK DRX Aerosol Monitor shows very good agreement with the TEOM with the appropriate size-selective inlet. Further, on an average, DRX has a response time that is about 8 seconds faster than that of the TEOM. Figures 2a, 2b, and 2c illustrate the linear correlation between the DUSTTRAK DRX Aerosol Monitor and the TEOM for the data in Figures 1a, 1b, and 1c, respectively. It shows that individual size channels of the DUSTTRAK DRX Aerosol Monitor are highly correlated with the TEOM over a wide range of aerosol mass concentrations.

In summary, the DUSTTRAK DRX Aerosol Monitor can be used to simultaneously measure multiple size segregated mass fractions of the sampled aerosol without the need for size-selective inlets. It has high correlation with a standard reference equivalent method like the TEOM, which is widely used for environmental monitoring.

DUSTTRAK DRX Aerosol Monitor Advantages over TEOM

1. Faster response time.
2. Continuous and faster data acquisition rate (once per second).
3. Simultaneous measurement of size segregated mass fraction concentrations.
4. Size segregated mass fraction data is shown in real time.
5. No need for multiple instruments for different size fraction measurements.
6. No need for size-selective inlet conditioners.
7. No consumables and low maintenance.
8. Much lower cost of ownership—one instrument can do the work of five!



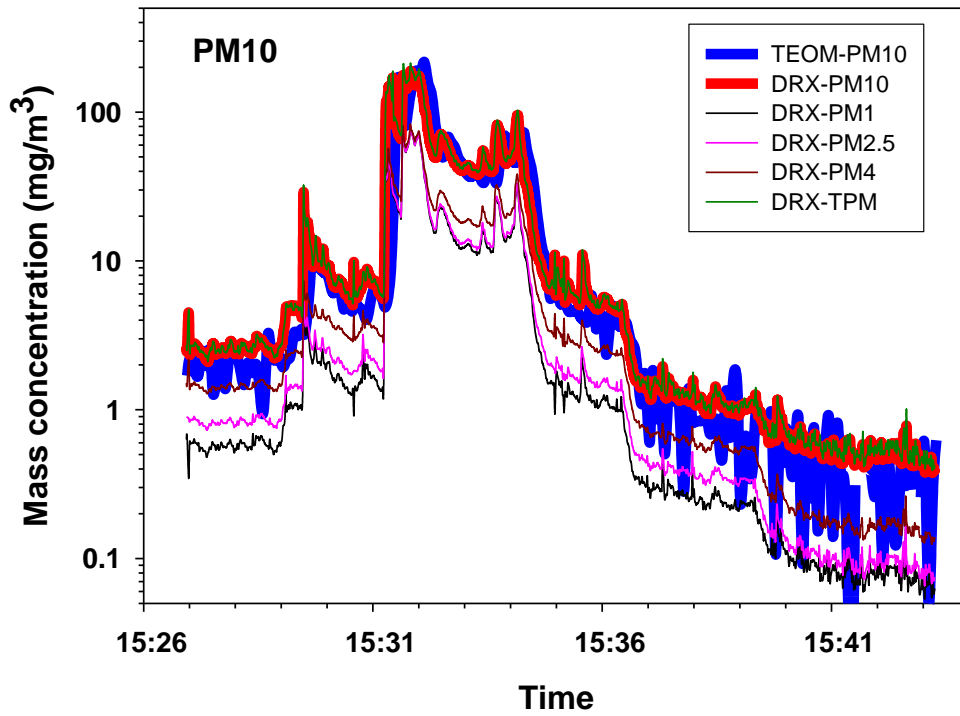


Figure 1a. Comparison of Arizona Road Dust (A1) mass concentration measured by the DUSTTRAK DRX and the TEOM with a PM_{10} impactor.

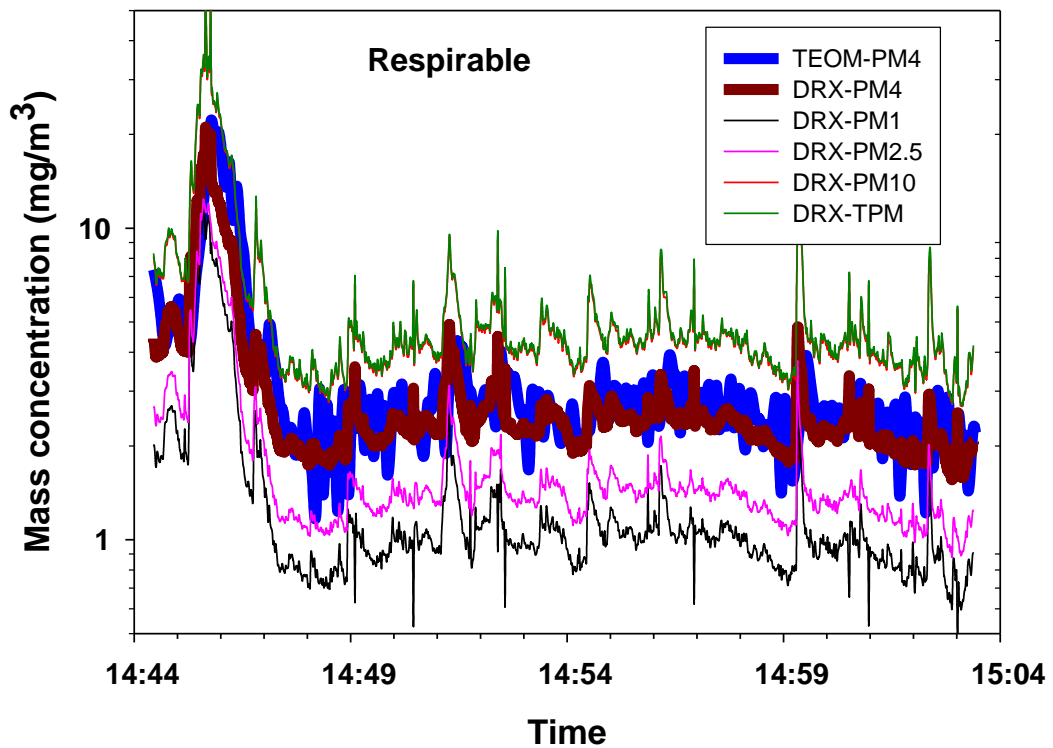


Figure 1b. Comparison of Arizona Road Dust (A1) mass concentration measured by the DUSTTRAK DRX and the TEOM with a Respirable impactor.

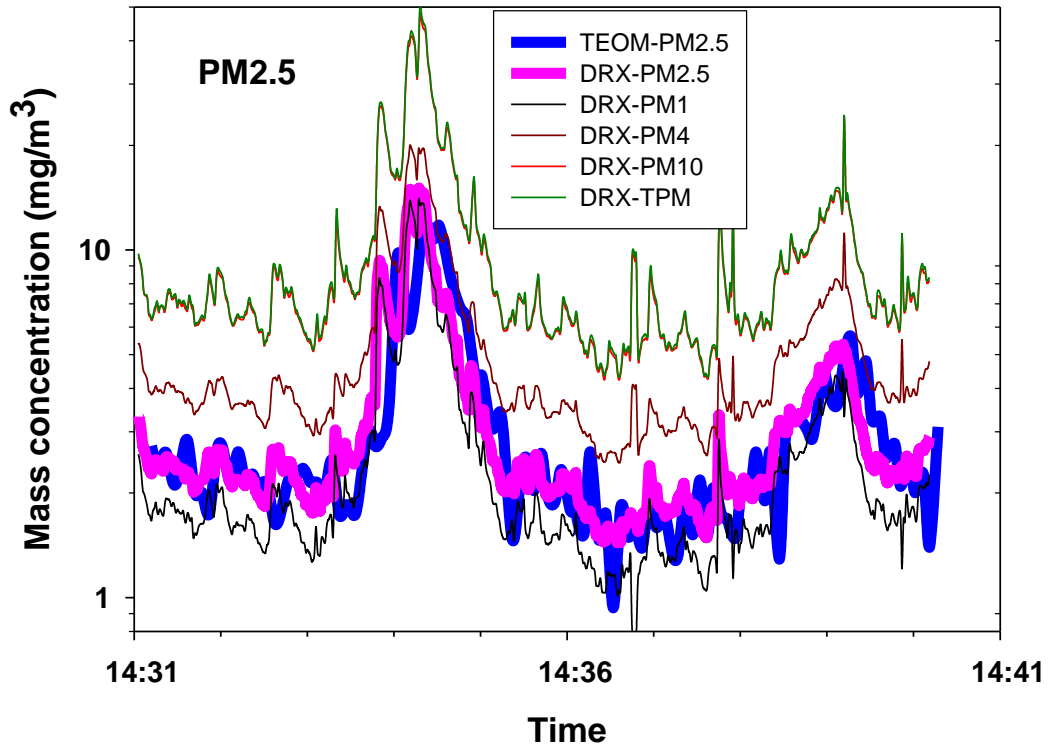


Figure 1c. Comparison of Arizona Road Dust (A1) mass concentration measured by the DUSTTRAK DRX and the TEOM with a $\text{PM}_{2.5}$ impactor.

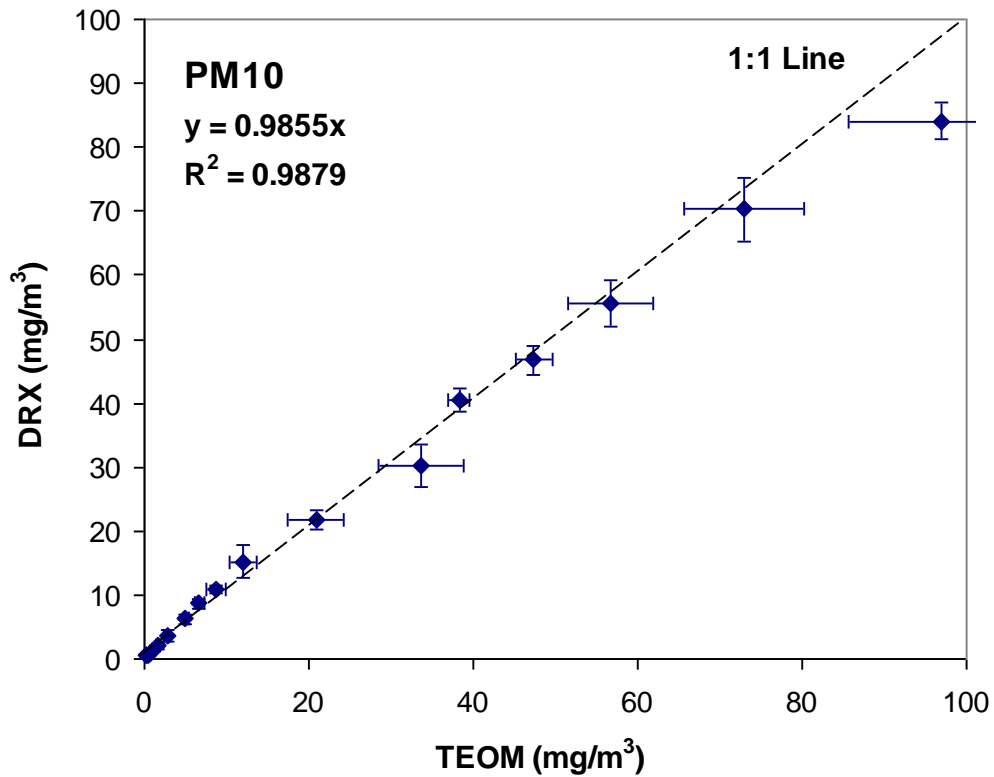


Figure 2a. Linear correlation between DUSTTRAK DRX and TEOM for Arizona Road Dust (A1) mass concentration measurement. The TEOM ran with a PM_{10} impactor.

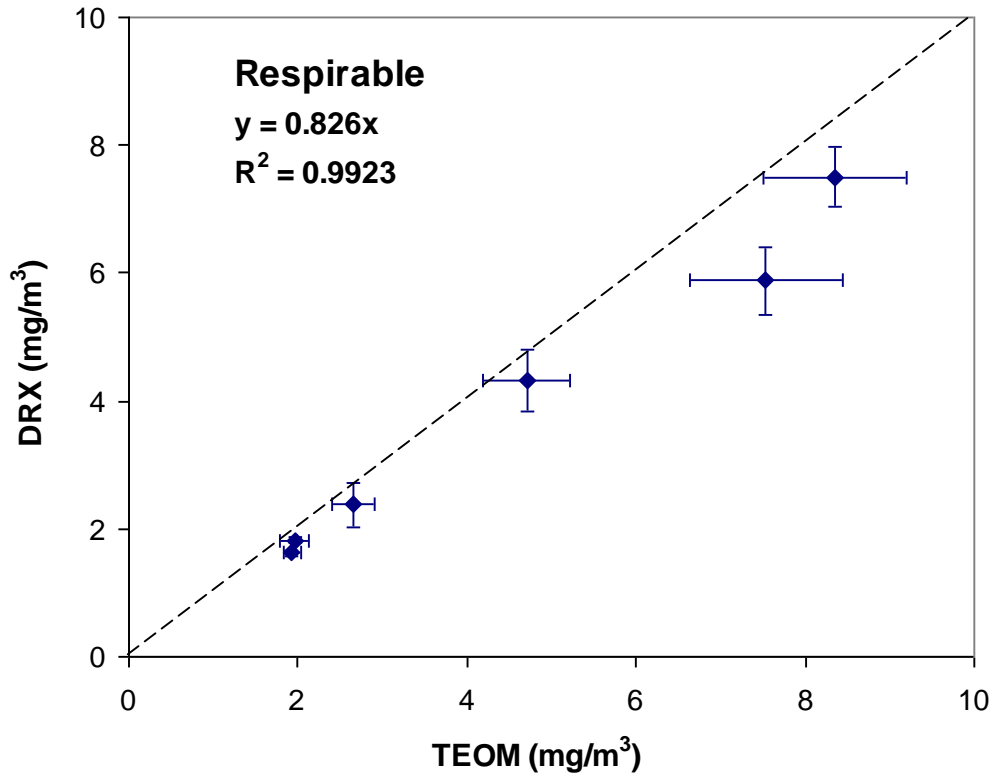


Figure 2b. Linear correlation between DUSTTRAK DRX and TEOM for Arizona Road Dust (A1) mass concentration measurement. The TEOM ran with a Respirable impactor.

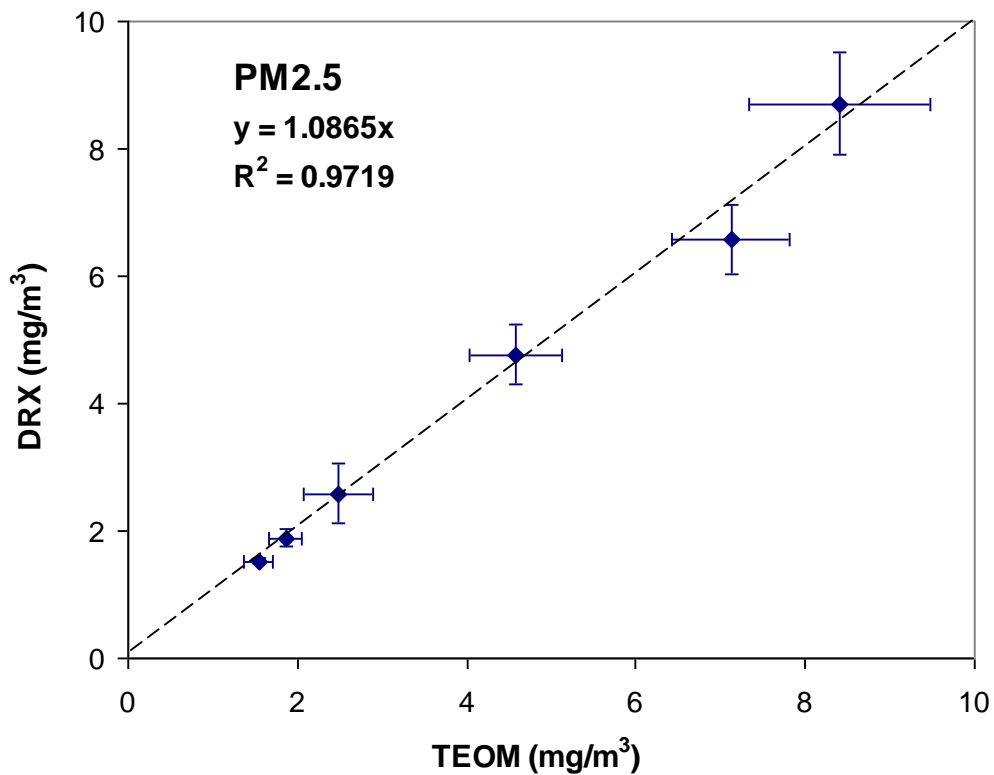


Figure 2c. Linear correlation between DUSTTRAK DRX and TEOM for Arizona Road Dust (A1) mass concentration measurement. The TEOM ran with a PM_{2.5} impactor.



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