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I find the experimental measurements disappointing. The instruments chosen are not the most accurate and precise that could have been used. They could have used batteries and an inverter to power a much better quality CPC and a nephelometer that had better response below 0.1 μm. If they had been on a bus with people riding on it or where making personal measurements, their choice of measurement systems would make sense, but given the nature of the study, the lack of best practice instruments is disappointing. They have missed an opportunity to make a real contribution to the problem. Since diesel has a peak around 70 nm, they are underestimating the PM2.5 mass with the DataRAM. Since 70 nm particles deposit much more effectively than 0.25 μm particles, lack of data in this size range is a significant deficiency. An instrument like an FMPS would have proven much more useful because they could get high time resolution measurements from 5.6 to 560 nm.

They also substantially underestimate the ultrafine particles (<20nm) with the PTrak. They state "This study illustrates that the P-Trak is a good instrument for measuring particulates that have aged." However, their set-up is such that the particles have not had time to age and thus, they are missing the large number of 10 to 20 nm particles. Even the 3022 that was used in comparison in the quoted study is an old design instrument. I would have looked at a 3781 with a 50% cut point of 6 nm to properly characterize the ultrafine particle number concentrations.

I have never used the DataRAM-4 monitors. These are the next generation monitors after the DataRAM 2000s. We have the personal DataRAM 1000 and 1200s, which are meant to be worn. The DataRAM-4 is a portable but not a personal monitor. Regardless, I expect that some of the same limitations will hold. The investigators did a decent job characterizing the instruments before the initial study at different concentrations using a like source of particles. However, you see that the coefficient of variation (Tables 3 and 4) is fairly high, especially for low concentrations. Also, there appears to be a predictable bias among the monitors (e.g., Fig 22 and calibration curves).

As far as I can tell from the report, the calibration curves that were developed were not used to correct the data from the monitors, even though the slopes and intercepts are not close to 1 and 0, respectively. Also, the monitors were recalibrated before the final study so the calibration curves would not be applicable. No collocation experiment was conducted following the recalibration, unless I missed something. Therefore, the reported results likely have a monitor bias. This could be why the ambient monitor is higher than the monitors in the bus. However, there is also the issue of pollutants building up in the vicinity of the track from the exhaust and resuspended dust (a bigger issue for the initial study where the ambient measurement was in the center of the track).

I did not see calibration curves for the gaseous species using the SEMTECH-D gas analyzer. We have no information on its accuracy and precision.

The work they did to seal the leaks may make the bus they used unrepresentative of the bus fleet. Are most buses really sealed properly? Thus, in actual practice, the exposure would be much higher.

I found the beginning of the report hard to read since they outlined the experimental design with the names of the instruments before defining the nature of the instruments. I knew what they were, but I suspect that many less versed in particle measurements will have a tough time with that section.

I am not sure why they made runs with the windows open. One would have expected dilution and infiltration of the ambient aerosol. Why seal the doors and then open the windows? Those runs could have been used more profitably.

They have evaluated the technology on a bus. However, I wonder how well the retrofits are installed on a fleet and how well they are maintained. Such information was beyond the scope of this study, but clearly there is a need to look at how these technologies work in real applications and over time.

A reference they should review is

Title: Predicting airborne particle levels aboard Washington State school buses
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