

Evaluation of Low-Cost Monitor for Particles in Heavy Vehicle Manufacturing

Samuel Jones, Levi Mines, and Thomas M. Peters

Department of Occupational and Environmental Health, The College of Public Health, The University of Iowa



Background

- In heavy vehicle manufacturing plants, personal occupation exposure assessments are timely and expensive.
- Several processes in the plant include machining, welding, and plasma cutting.
- Use of direct read instruments to estimate personal exposure to airborne particulates can be efficient and cost effective.

Objective

Evaluate effectiveness of low-cost particle detection device (Dylos DC1700) to standard mass photometer (personal DataRAM).

Methods

Equipment

- Personal DataRAM (pDR-1200) with SKC pump, PVC filter and respirable cyclone (~\$5,000) $D_{50}4.0$
- Dylos DC1700 (~\$400), small particle channel between 0.5um and 2.5um and large particle channel > 2.5um

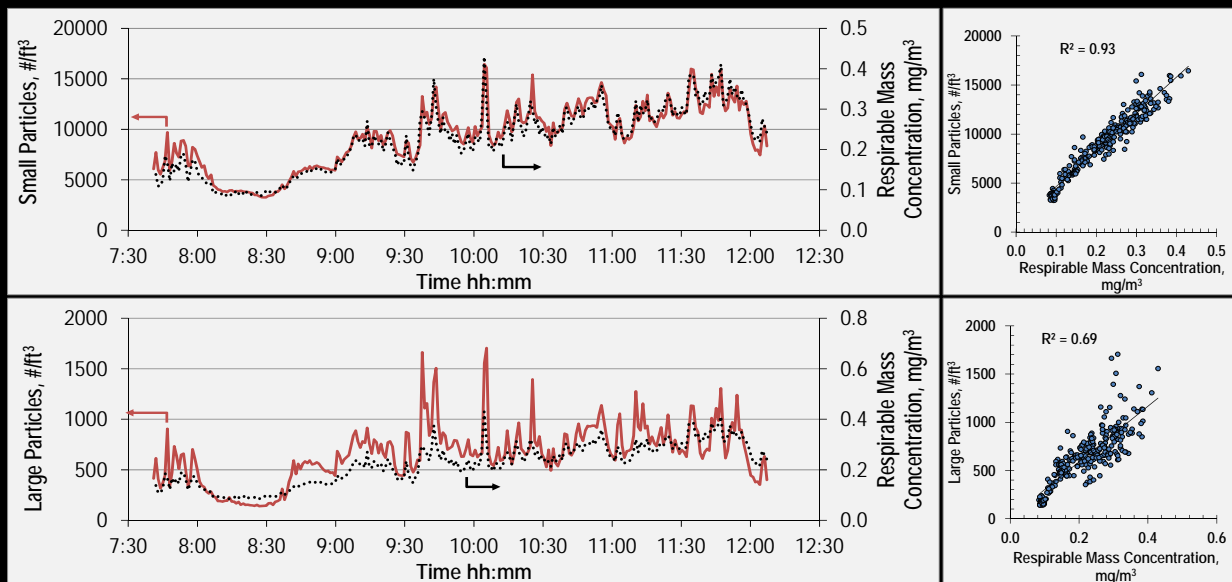
Data Acquisition

- Locations
 - Machining area - Dominated by oil mist
 - Welding area - Dominated by metal fume
 - Mixed area containing both machining and welding - Combination of oil mist and metal fume
 - Plasma cutting area - Enclosed metal fume
- Sampling period: 2-4 hours depending on cycle time

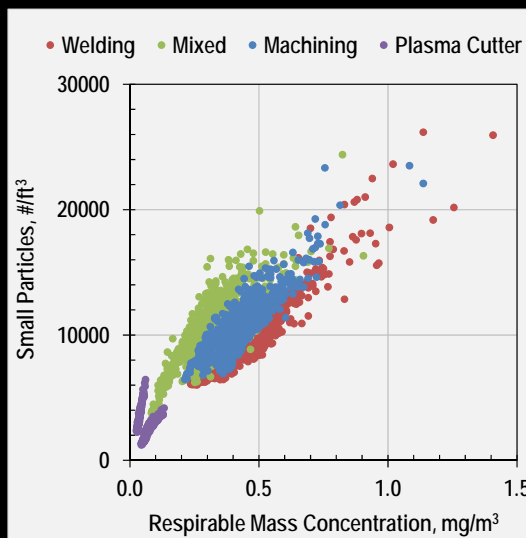
Dylos DC1700 SKC pump / pDR 1200



Results



Time correlated data for pDR and Dylos, small particle and large particles (left). Correlation between pDR and Dylos (right).



All concentrations measured at each location inside vehicle manufacturing plant

Conclusions

- Concentrations measured with the Dylos tracked those measured with the pDR well
- Concentrations measured with the Dylos correlated well with those measured with the pDR
 - Small particle concentrations $R^2 = 0.87$
 - Large particle concentrations $R^2 = 0.64$

Future Work

- Use low-cost monitoring to supplement traditional personal exposure monitoring
- Develop correction factors to account for differences in light scattering properties of aerosols by process

Acknowledgements

We greatly appreciate the support from the heavy vehicle manufacturing industry who made this work possible.