

Interactive comment on “Real-time characterization of particle-bound polycyclic aromatic hydrocarbons in ambient aerosols and from motor-vehicle exhaust” by A. Polidori et al.

A. Polidori et al.

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Dear Reviewer 1,

The authors would like to thank you for reviewing our paper. However, we found the reviewer's comments to be quite generic, and lacking the details and degree of specificity that would allow us to address the concerns more effectively. In an effort to further improve the organization and overall quality of our paper we would like to invite reviewer 1 to provide us with more detailed suggestions, and, if possible, also with editorial corrections.

1) Reviewer 1: The manuscript reports (1) measurements of the ambient particles at a site in Los Angeles, (2) a dynamometer test results of diesel trucks, and (3) a exposure-

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risk assessment result due to the particulate PAHs. While the authors did present a wide range of measurement results, my major concern is that no further understanding or insight be gained by presenting the three results in one manuscript.

Authors: The authors strongly disagree with this comment. With the exception of the excellent work by Marr et al. about the sources and transformations of particle-bound PAHs in Mexico City (see, Marr, L.C., Dzepina, K., Jimenez, J.L., Reisen, F., Bethel, H.L., Arey, J., Gaffney, J.S., Marley, N.A., Molina, L.T., Molina, M.J., Atmospheric Chemistry and Physics, 6: 1733-1745, 2006, for example) none of the manuscripts in the available literature deals holistically with the PAH response of the PAS monitor, and explains what it means under different settings. In this respect, no other work conducted in the US has ever described the relationships between the PAS signal and the p-PAH concentrations in a way that is more than just anecdotal. In addition, this is the first time that complete PAH measurements were obtained and analyzed in the port area of a major metropolitan city.

A list of the most relevant papers related with real-time measurements of particle-bound PAHs is reported below:

Bukowiecki, N., Kittelson, D.B., Watts, W.F., Burtscher, H., Weingartner, E., Baltensperger, U. Real-time characterization of ultrafine and accumulation mode particles in ambient combustion aerosols, *Journal of Aerosol Science*, 33 (8): 1139-1154, 2002.

Chetwittayachan, T., Shimazaki, D., Yamamoto, K.A. A comparison of temporal variation of particle-bound polycyclic aromatic hydrocarbons (pPAHs) concentration in different urban environments: Tokyo, Japan, and Bangkok, Thailand, *Atmospheric Environment*, 36 (12): 2027-2037, 2002.

Chen, S.-C. and Liao, C.-M.: Health risk assessment on human exposed to environmental polycyclic aromatic hydrocarbons pollution sources, *Sci. Total Environ.*, 366, 112-123, 2006.

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Dunbar, J.C., Lin, C-I., Vergucht, I., Wong, J., Durant, J.L. Estimating the contributions of mobile sources of PAH to urban air using real-time PAH monitoring, *The Science of the Total Environment* 279: 1-19, 2001.

Kelly, K., Wagner, D., Lighty, J., Nunez, M.Q., Vazquez, F.A., Collins, K., Barud-Zubillaga, A. Black carbon and polycyclic aromatic hydrocarbon emissions from vehicles in the United States-Mexico border region: Pilot study, *Journal of the Air Waste Management Association*, 56 (3): 285-293, 2006.

Matter, U., Siegman, H.C., Burtscher, H. Dynamic Field Measurements of Submicron Particles from Diesel engines, *Environmental Science Technology*, 33: 1946-1952, 1999.

Miguel, A.H., Kirchstetter, T.W., Harley, R.A., Hering, S.V. On-road emissions of particulate polycyclic aromatic hydrocarbons and black carbon from gasoline and diesel vehicles, *Environmental Science Technology*, 32(4): 450-455, 1998.

McDow, S.R., Giger, W., Burtscher, H., Schmidt-Ott, A., Siegmann, H.C. Polycyclic aromatic hydrocarbons and combustion aerosol photoemission, *Atmospheric Environment*, 24A, 2911-2916, 1990.

Niessner, R. The Chemical Response of the Photo-Electric Aerosol Sensor (PAS) to Different Aerosol Systems, *Journal of Aerosol Science*, Vol. 17, No. 4, pp. 705-714, 1986.

Rogers, F., Arnott, P., Zielinska, B., Sagebiel, J., Kelly, K.E., Wagner, D., Lighty, J.S., Sarofim, A.F. Real-time measurements of jet aircraft engine exhaust, *Journal of the Air Waste Management Association*, 55 (5): 583-593, 2005.

Siegmann, K., Siegmann, H. C. Fast and reliable in situ evaluation of particles and their surfaces with special reference to diesel exhaust, *SAE Technical Paper Series*, 2000-01-1995, 1-7, 2000.

Wallace, L. Real-Time Measurements of Black Carbon Indoors and Outdoors: A Com-

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parison of the Photoelectric Aerosol Sensor and the Aethalometer, Aerosol Science and Technology, 2005.

Each of these works touched on either the actual data, on the PAH characterization of the monitor or, as in Bukowiecki et al. (2002), on the ambient and dynamometer data (albeit the scope of their work was more limited than ours). In addition, none of the above mentioned manuscripts explored in detail the relationships between the PAS signal and various p-PAH species, or made any attempt to estimate the cancer risk associated with exposure to ambient p-PAHs in an urban areas.

2) Reviewer 1: The major point in the manuscript is rather on the relationship among the instrument results, especially, between the photo-electric aerosol sensor and the particulate levels from the integrated-filter samples. It needs more data analysis on the behavior of the ambient particulate PAHs.

Authors: Reviewer 1 stated that the paper "needs more data analysis on the behavior of the ambient particulate PAHs."; however, the authors believe that the way p-PAHs are emitted and transformed in the Long Beach atmosphere has been described in sufficient detail in the paper. This work is comprehensive in its scope, spanning from detailed size distributions and chemical composition to risk assessment. A more in depth data analysis of the p-PAH measurements could be the focus of a different paper.

3) Reviewer 1: The dynamometer test results are potentially important but with the data given in the manuscript it is hard to carry out further in-depth data analysis.

Authors: The reviewer also reported, "The dynamometer test results are potentially important but with the data given in the manuscript it is hard to carry out further in-depth data analysis." It is unclear to us what is meant by reviewer 1 under "further in-depth data analysis", mainly because he/she didn't include any specific suggestions on the additional analysis/calculations that we could perform on our dataset. Because of the wide scope of this manuscript and of space limitations, we could not address the differences in particle reduction using Zeolite-based or vanadium-based catalytic

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converters. However, this and other important issues related to the use of SCRT technologies are the focus of another work conducted at the same dynamometer facility (using the same test-vehicles and experimental set-up described in here) that has just been submitted for publication in Atmospheric Environment by our research group (the title is reported below)

"Physical Properties of Particulate Matter (PM) from Newer Heavy Duty Diesel Vehicles Operating with Advanced PM and NO_x Emission Control Technologies"

4) Reviewer 1: The lung-cancer risk analysis itself is an elementary one and can be an important part if more detailed data analysis on the characteristics of the particulate PAHs at the sampling site. Thus, at present form, the manuscript is not suitable for publication at the Atmospheric Chemistry and Physics. I recommend the manuscript be resubmitted with a focused research goals.

Authors: It would be virtually impossible to put together a more sophisticated lung-cancer risk analysis with the available data. Besides, only a few papers focused on PAS-PAH measurements (also published IN ACP) have attempted a similar (or even less complicated) risk assessment analysis. Despite some degree of uncertainty, our analysis is still informative in that it shows that exposure to p-PAH is considerably lower in the Los Angeles port area than in other metropolitan areas such as Mexico-City. This is a surprising and potentially important observation that cannot be ignored. As reported in our manuscript "Marr et al. (2004) calculated a mean cancer risk level for p-PAHs of approximately 5×10^{-5} (a value 10 times higher than the highest p-PAH risk estimated in Wilmington) for lifetime exposure to p-PAHs concentrations found along a typical roadway in the Mexico-City metropolitan area."; These results are extremely important in terms of exposure to p-PAHs and public health.

5) Reviewer 1: Two minor points are; (1) to use a consistent notation such as "Km"; and "km"; in section 2.1 and (2) figure caption can be more improved.

Authors: In section 2.1 all "km"; were changed to "Km"

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Interactive comment on Atmos. Chem. Phys. Discuss., 7, 17475, 2007.

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