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Interactive comment on "Chemical and stable carbon isotopic composition of PM$_{2.5}$ from on-road vehicle emissions in the PRD region and implication for vehicle emission control policy" *by* S. Dai et al.

Anonymous Referee #2

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This paper describes PM2.5 and chemically speciated measurements of emissions in a tunnel in the PRD region in China. PM2.5 emissions and composition are compared with those in the same tunnel in 2004. Differences are discussed with respect to regulations enacted in the interim period.

The paper is generally well constructed, although I suggest that the paper be carefully edited for proper English. For example, p. 28887, line 5, "are of our concern", p. 28889, line 20, "hygrothermost". Regarding the methodology, PM2.5 was collected on quartz

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fiber filters. These have a strong potential for absorbing volatile organic compounds. Without a means of correcting for this positive sampling artifact, OC and semi-volatile compound concentrations will be high-biased. This should be acknowledged and discussed. del-13C is calculated using a reference standard. What is the standard?

Relatively high emissions of NaCl were measured in the tunnel, indicative of resuspended sea salt, considering that the authors discounted road salting. Elemental Na, Ca, Mg, and K were higher than their water-soluble forms. This is understandable for K, whose water-soluble fraction in mineral dust is expected to be low. However, the authors' suggestion that non-soluble Na was chelated with organics is implausible. The high correlation between EC and Fe suggests that Fe comes from tailpipe emissions. However, Fe is also moderately correlated with crustal elements Al and Ca. EC is also moderately correlated with Al and Ca, suggesting that some EC comes from resuspended dust. For completeness, Table S4 and a discussion of the correlations should also contain PM2.5 and OC. It is clear that while PM2.5, OC and EC emission rates decreased from 2004 to 2013, Fe, Al, Ca, Na and Cl emission rates increased significantly by more than a factor of three. The authors attribute this to increased resuspended road dust in 2013 which was explained by higher wind speed (3.8 m/s in 2013 versus 3.0 m/s in 2004). It is unlikely that this minor difference in wind speed could account for the large increase in resuspended dust/salt from 2004 to 2013. This could be due to heavier traffic in 2013 but examination of the number of vehicles per hour in 2013 and 2004 suggests that there were fewer vehicles per hour in 2013. A more plausible explanation is that there was a lot more dust on the road in 2013. It would have been helpful had the authors sampled the road dust directly and measured its composition.

The authors attribute lower PM2.5, OC, and EC emissions to a higher percentage of low-emission LPGV and lower percentage of DV vehicles in 2013. There is indeed a lower percentage of DV vehicles in 2013 but the percentage of LPGV vehicles is not given in the He et al. (2008) paper with respect to 2004. While fleet composition is

discussed, it would be helpful to systematically relate variations in chemical composition to fractional abundance of vehicle type over the 10 sample periods. For example, this could be done for OC/EC, non-volatile PAH/OC and hopane/OC. The characterization of del-13C is interesting but I don't believe it uniquely identifies vehicle emissions. The coal/fuel oil signature is roughly the same. Finally, the estimation of reconstructed mass should be revisited. The geological component can be estimated from Al. From the literature, a typical road dust Al composition is 8-10% (9% average). From Table 1, we have: resuspended geological dust = $(100/9)*3.15=35$. Sea salt is $3.125*2.88=9$ (assuming sea salt is 32% Na). Add these to NH4+SO4 (0.77), EC (16.4), 1.4*OC (23.4) and the sum is 84.6 or 92% of PM2.5.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 28885, 2014.

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