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Source apportionment of traffic-derived PM_{10} and derivation of PM_{10} emission factors for exhaust and non-exhaust road transport sources based on measurements in the Hatfield road tunnel

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Despite increasingly strict legislative controls on vehicle emissions, road transport remains one of the most important sources of airborne particulate matter (PM), especially in urban areas. In emission inventories and models it is often assumed that fuel combustion (specifically diesel exhaust) is the main source of PM from road vehicles. However, there are a number of 'non-exhaust' processes which can also result in PM being released directly to the atmosphere. The most important of these involve mechanical abrasion, such as tyre, brake and road surface wear, and the resuspension of dust which collects on the road surface. Corroded vehicles and infrastructure materials also contribute to ambient PM. However, the data relating to non-exhaust particles is relatively scarce and more accurate information is required for emission models and inventories.

This paper presents the results of a tunnel study to estimate the PM_{10} emissions resulting from non-exhaust sources of road transport. For the purpose of this study, PM_{10}samples were collected from the entrance and exit of the Hatfield road tunnel in the UK. The samples were analysed for elements and organic compounds to identify tracers for tyre, brake and road wear and resuspended dust sources. The dataset generated provided a detailed picture of the inorganic and organic (particularly PAHs)

constituents of PM_{10} in a tunnel environment. Information from the compositional analyses of the samples and literature was used to identify chemical tracers for different sources.

Absolute Principle Component Analysis (APCA) was used to apportion the particle mass into exhaust and non-exhaust contributions. Multiple Linear Regression Analysis (MLRA) was performed on the absolute component scores. As a result of the analysis contribution of the various sources as a percentage of PM_{10} was estimated as follows: diesel exhaust (25%), petrol exhaust (21.6%), resuspended soil (10.7%), tyre and brake wear (22.6%), road surface wear (12.2%) and unexplained (7.6%). Emission factor for PM_{10} was deduced to be 48.4 mg/vkm from the combined exhaust and none-exhaust sources. The individual emission factors (mg/vkm) were calculated to be: exhaust (21.8), resuspended soil (5.7), tyre and brake wear (10.7) and road surface wear (5.9).

The presentation will discuss the appropriateness of the methodology for estimating real world non-exhaust emission factors and will evaluate the results in relation to other studies. It will also discuss whether the combined use of inorganic and organic constituents can improve source apportionment of PM_{10}.