Evaluating the use of dust suppressant to control local PM_{10} concentrations

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Introduction

Around Europe cities are struggling to meet EU Limit Values for PM_{10} requiring ever more creative measures to control concentrations in PM_{10} hotspots. Trials have found that street sweeping alone is not effective. The combination of street sweeping and washing has led to decreased PM_{10} in some locations with decreases of 7-10% at the kerbside in Barcelona (Amato et al 2009) but other studies have found no effects. Similarly dust suppressants have had impressive results in some studies such as those in Sweden where Norman and Johansson (2006) found a reduction of 35% in ambient air PM_{10} levels and 29– 43% decreases were found in Klagenfurt, Austria (Hafner, 2007) but other studies have reported no benefits at all (Amato et al 2010).

The application of calcium magnesium acetate (CMA) dust suppressant was tested over two years at nine locations in London ranging from a busy urban centre street canyon to suburban streets around industrial areas; each location having its own distinct geographical and emissions characteristics, allowing an assessment of the impact of CMA in differing situations and at varying application rates.

Methods

Changes in ambient PM_{10} as a result of CMA application were tested using different assessment methods each with their own controls:

a) NO_X tracer methods which sought changes in NO_X:PM_{10} emissions ratios from CMA applications reasoning that CMA would affect PM_{10} but not tailpipe NO_X.

b) Meteorological statistical modelling to remove as much of the interfering behaviour of meteorology, giving a much better chance of observing the effect of an intervention or emissions change.

c) PM_{10} mass closure from measured PM chemical components.

d) Detailed analysis of PM_{10} measurements looking at diurnal variations in PM10 from road sources on days with CMA and days with no CMA.

Results

Three roads showed no decrease in PM_{10} concentrations. This may be explained by low concentrations of PM_{10} from sources that may be susceptible to control by CMA; the mean contribution of mineral PM to total PM_{10} mass concentration was 5%, tyre wear 6% and brake wear 14%. These are typical of most roads in London.

Decreases in local PM_{10} were found in an underpass but only during high CMA dosing. CMA led to a decrease of ~ 12% in annual mean PM_{10} at one road near a construction site and the local increment in PM_{10} concentrations decreased by between 18 and 41% when CMA was used on industrial sites and surrounding residential roads.

Conclusions

Although CMA is not an effective method to decrease PM_{10} on typical London roads it may have a role to play in controlling local PM_{10} on roads around industrial and construction sites. Local PM_{10} at locations with greater than expected NOX:Primary PM_{10} emissions ratios (those above the regression line in Figure 1) would be most amenable to control by CMA.

Assessment methods developed for this programme can be useful to assess other air quality management interventions.

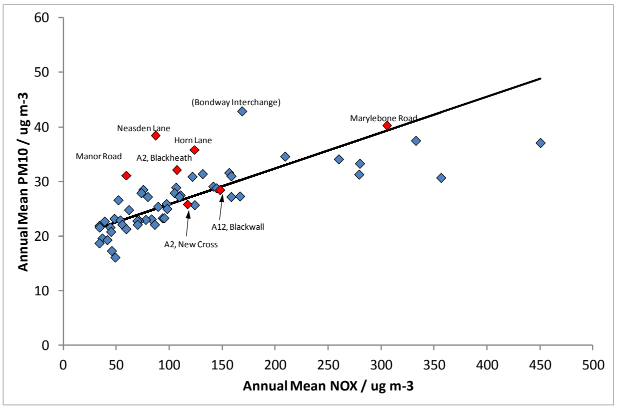

Figure 1 Annual mean PM_{10} vs NO_X; the regression line indicating a typical NO_X:Primary PM_{10} emissions ratio. Red diamonds = CMA study locations.

References

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