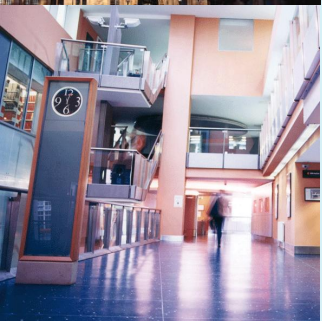
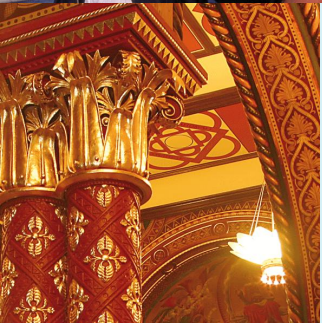


PM₁₀ measurements, sources and challenges

Gary Fuller, King's College London

LAQN Seminar, 21st September 2010



Contents

- PM_{10} compared to the Limit Value
- PM_{10} how have concentrations improved?
- Understanding urban PM_{10}
- New techniques
 - Chemical characterisation
 - Site specific analysis of background and road sources

PM₁₀ compared to the LV

UK EU time limit extension (defra 2010).

“..compliance with the daily limit value in Greater London is expected to be achieved in 2011.”

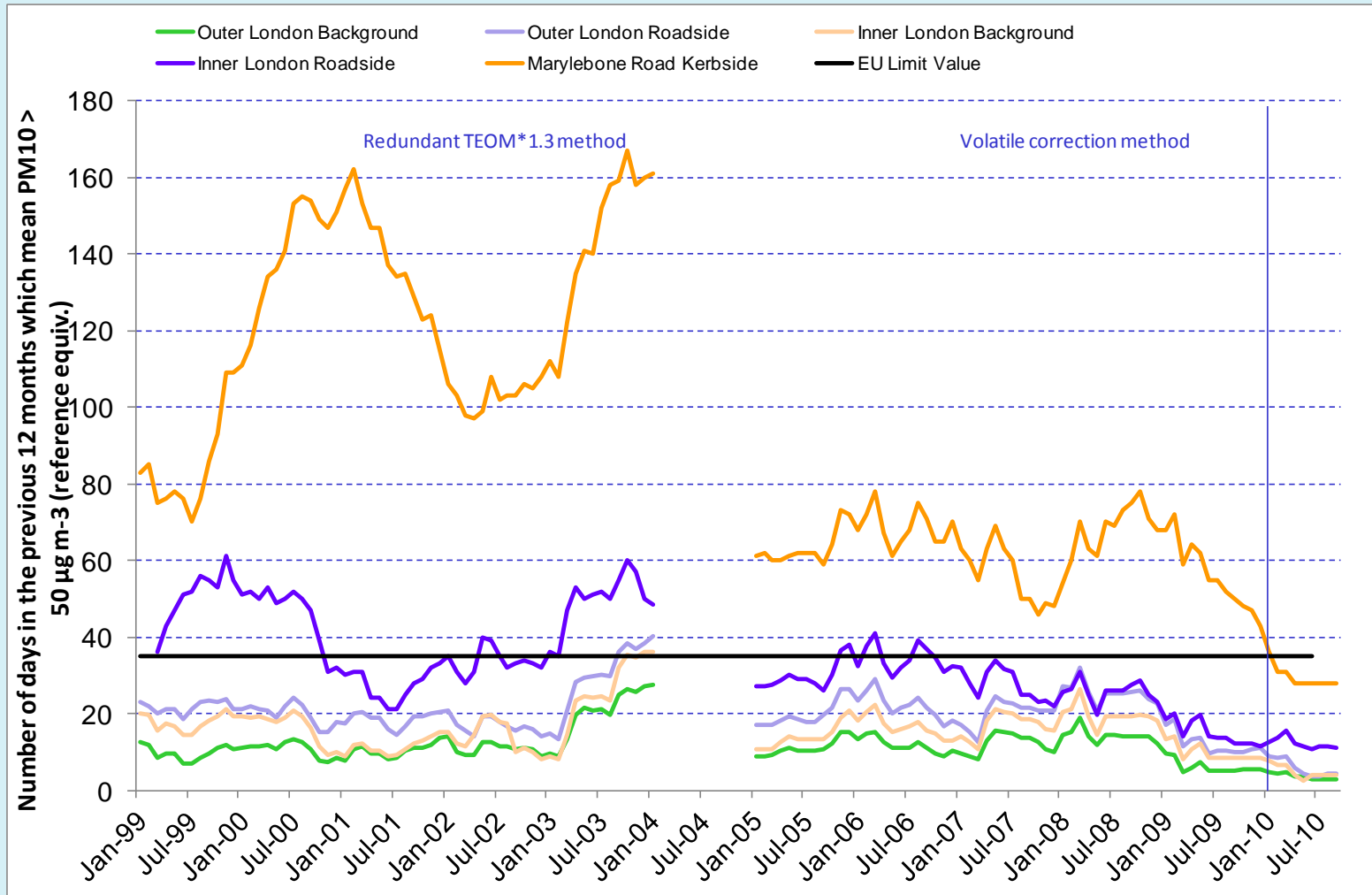
Mayor's Air Quality Strategy Consultation (2010).

“Modelling suggests that there will be no locations with relevant public exposure that will exceed the annual mean limit value in 2011. However, there remain some areas near the busiest roads in central London where the margin of between modelled concentrations and the limit value is very small “

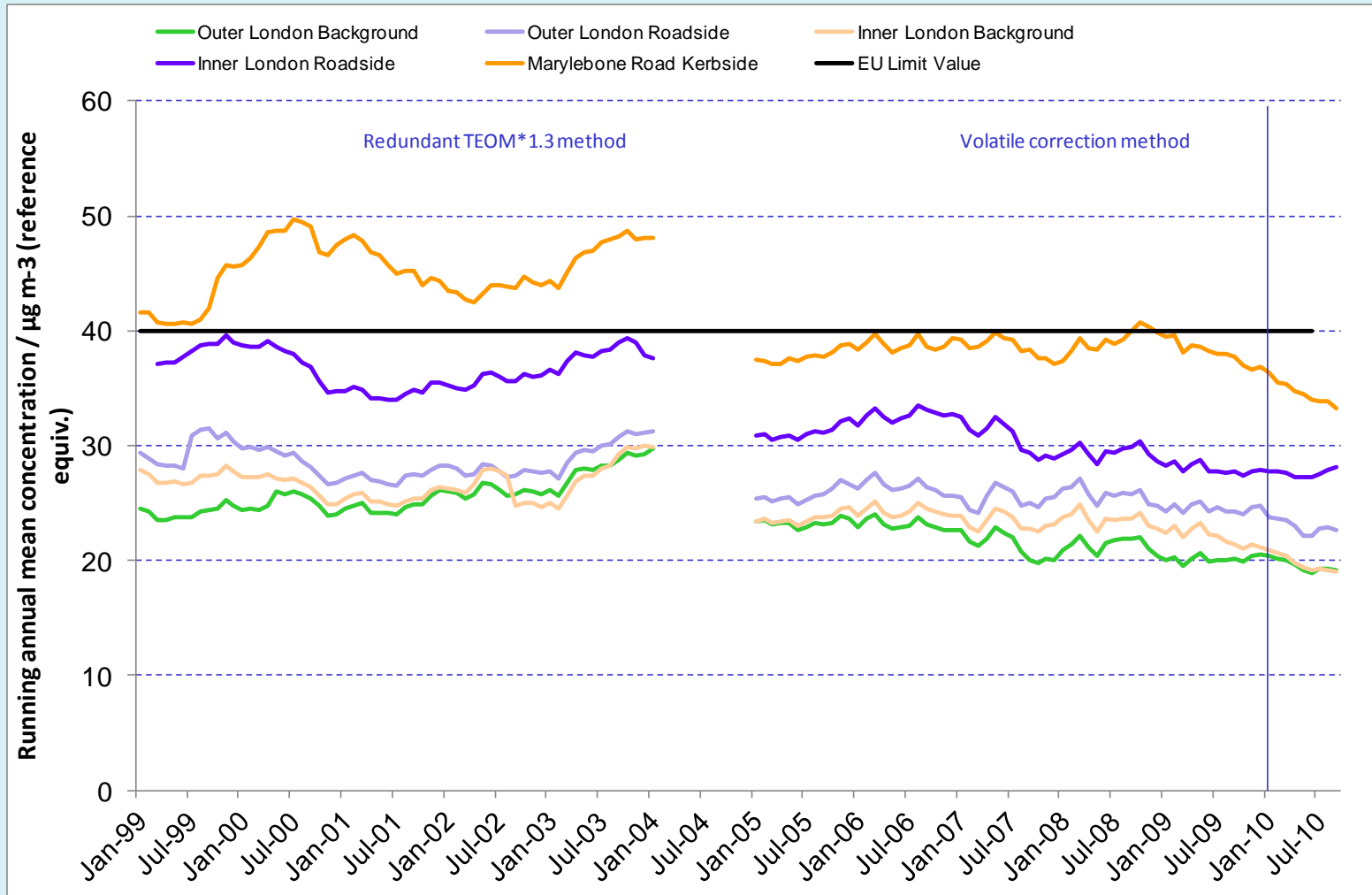
So how has this been achieved?

PM₁₀ how have concentrations improved?

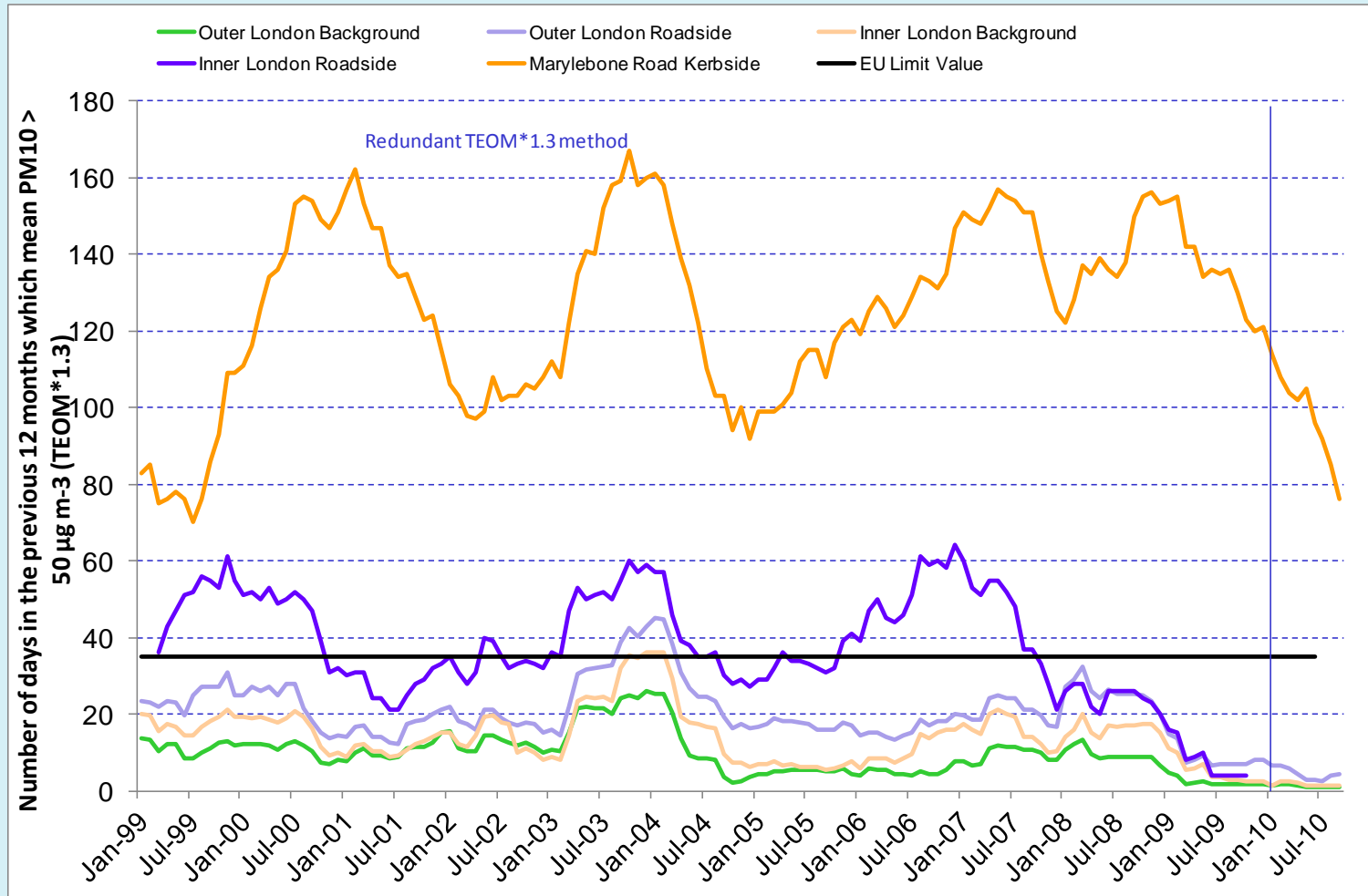
PM₁₀ – how have concentrations improved?



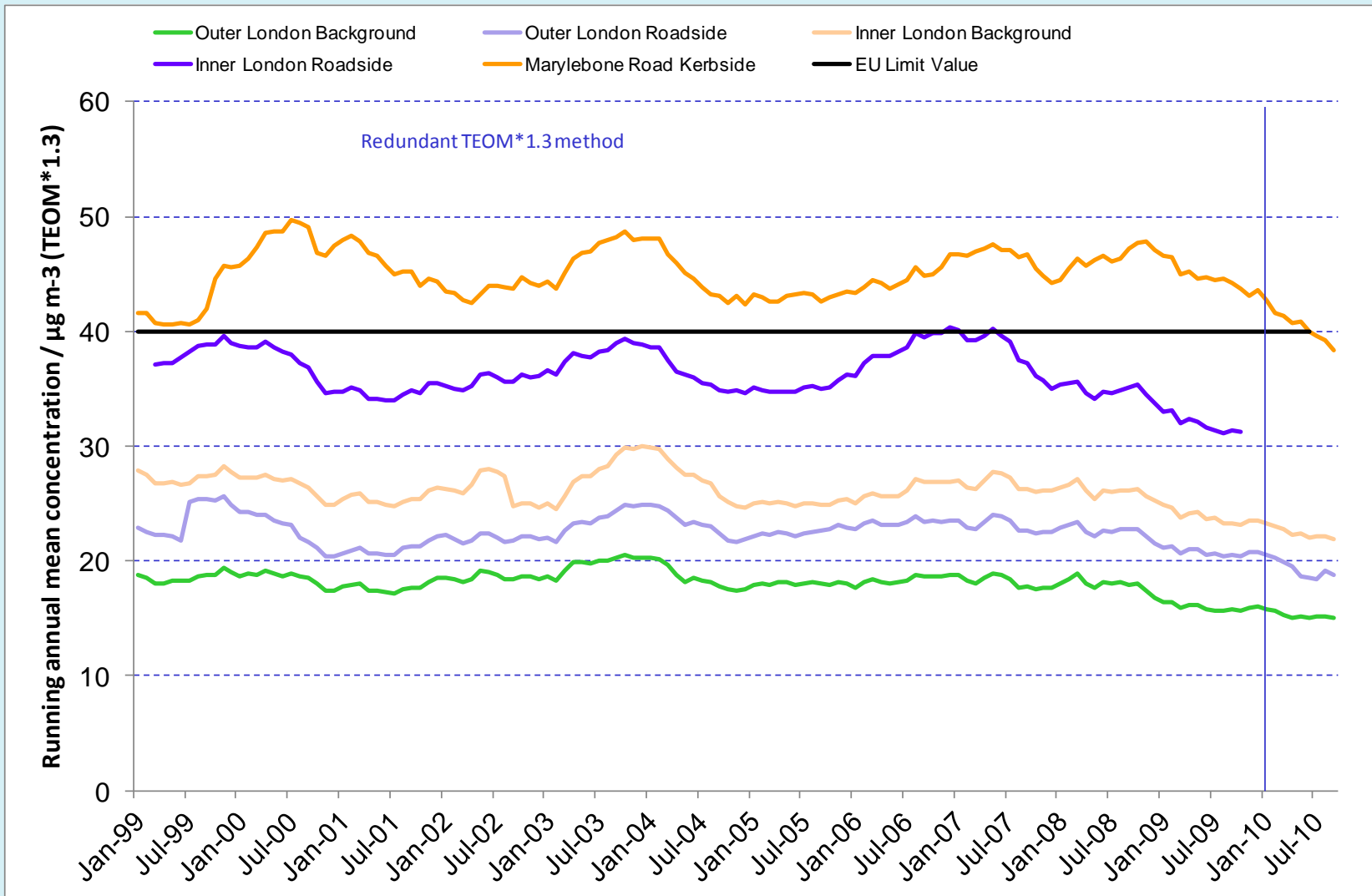
PM₁₀ – how have concentrations improved?



PM₁₀ – how have concentrations improved?



PM₁₀ – how have concentrations improved?

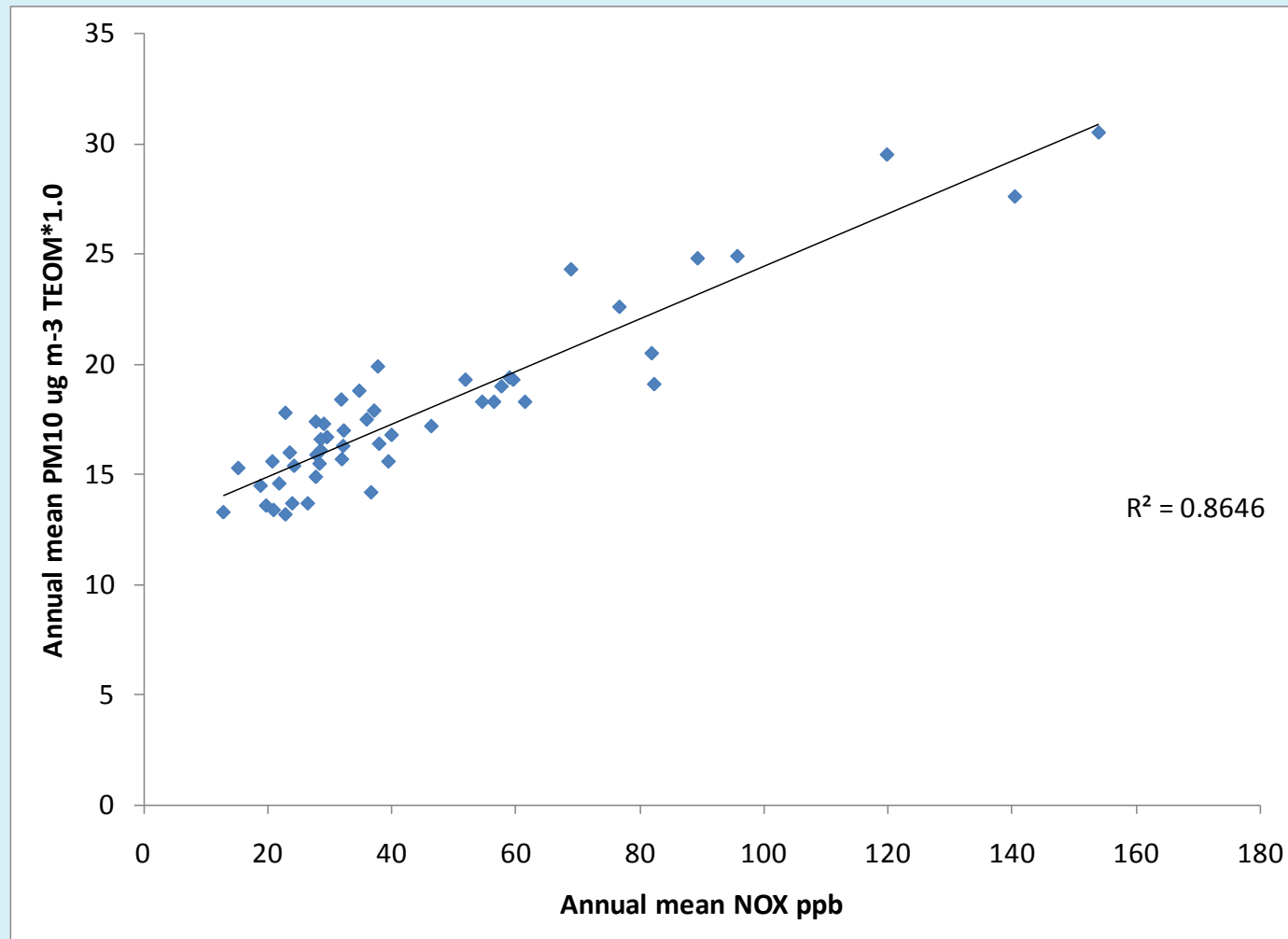


Understanding urban PM₁₀

Understanding urban PM10

Source apportionment - London

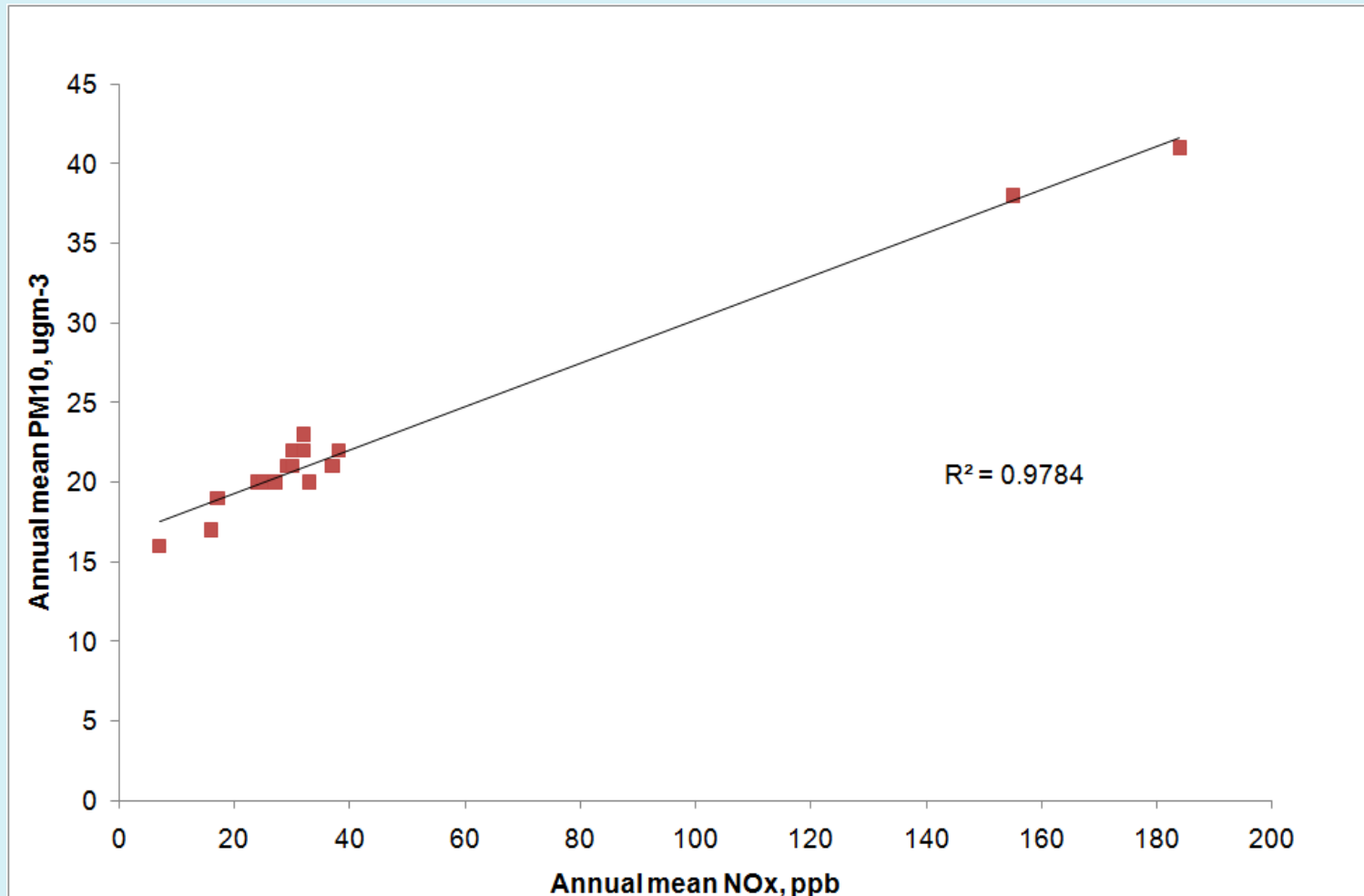
Fuller et al., (2002), Fuller and Green (2006) but measurements from YE July 2010



Understanding urban PM10

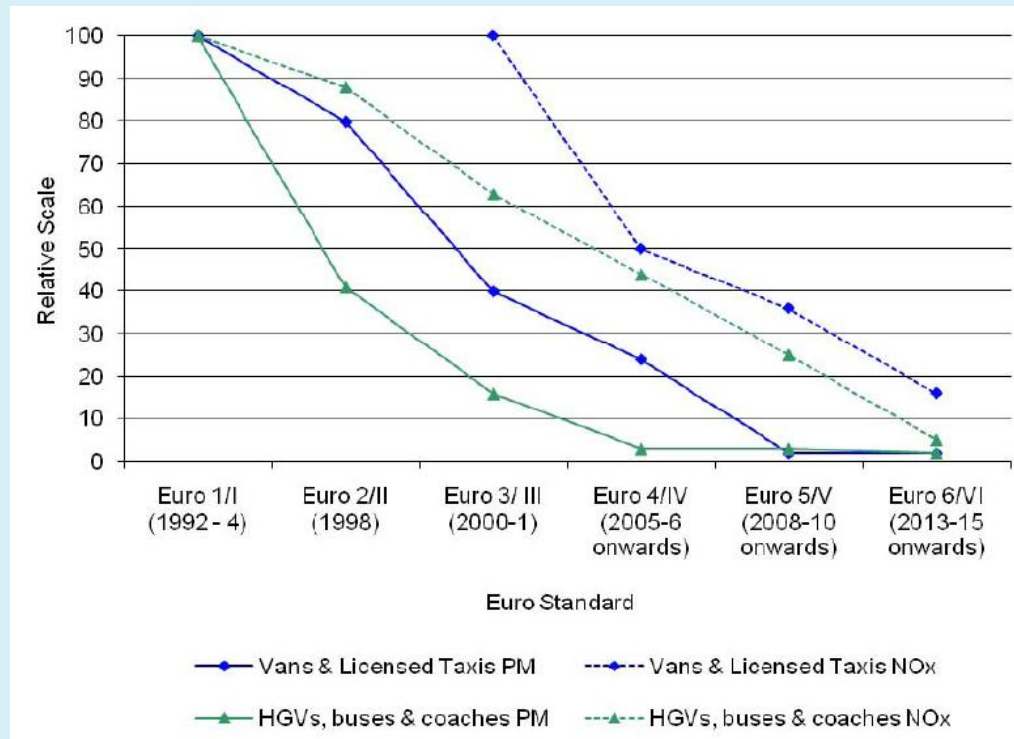
Source apportionment – Paris

Using measurements from AirParif (TEOM*1.0)



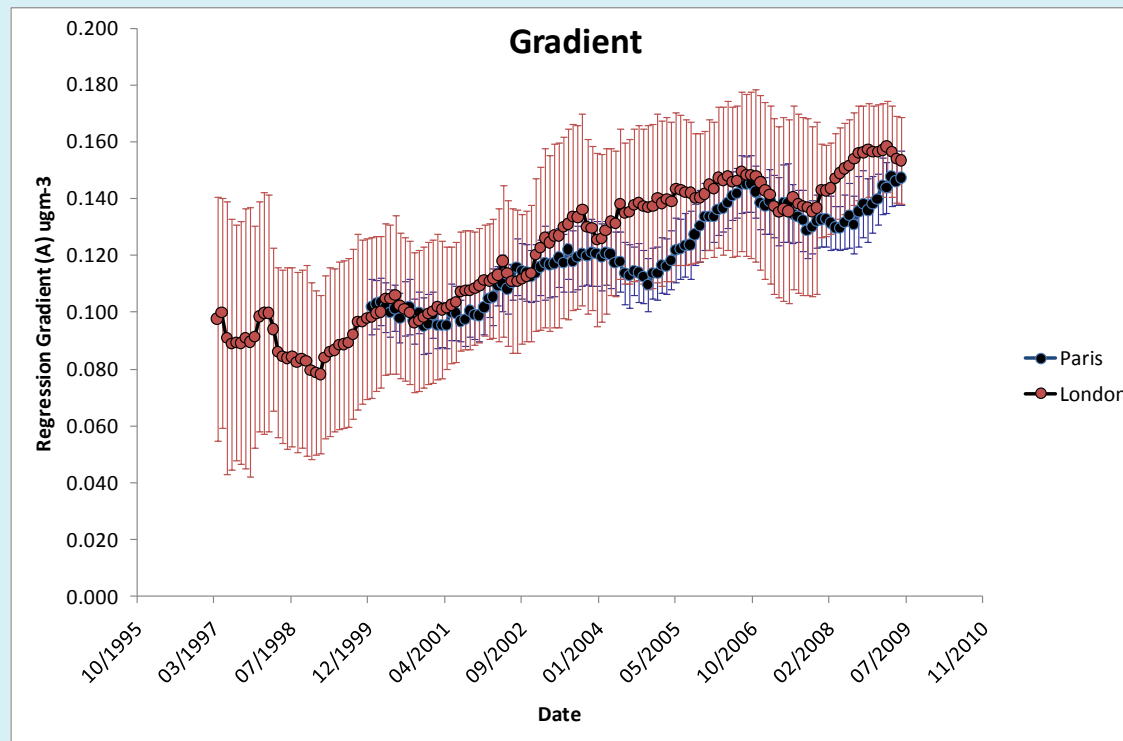
Understanding urban PM₁₀ Effects of Euro emissions standards

www.london.gov.uk/sites/default/files/Appendix%20B%20-%20Technical%20Information.pdf



- Euro emissions standards have placed emphasis on abating PM₁₀ emissions rather than NO_x.
- PM₁₀ / NO_x emissions should go DOWN.

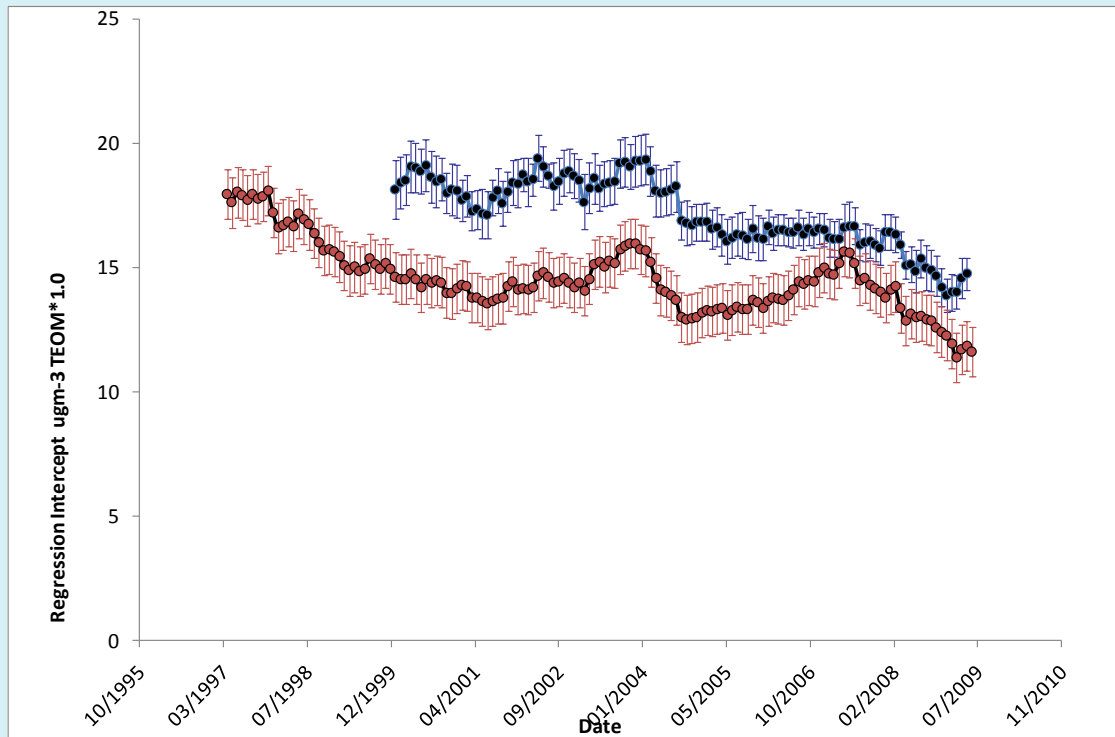
PM₁₀ - effects of Euro emissions standards



- ... but PM₁₀ / NO_x emissions have gone up in London (and Paris!)
- Maybe NO_x emissions were abated far better than expected?!
- So have Euro emissions standards for PM worked?
- Have to look at concentrations of primary PM₁₀

Understanding urban PM₁₀

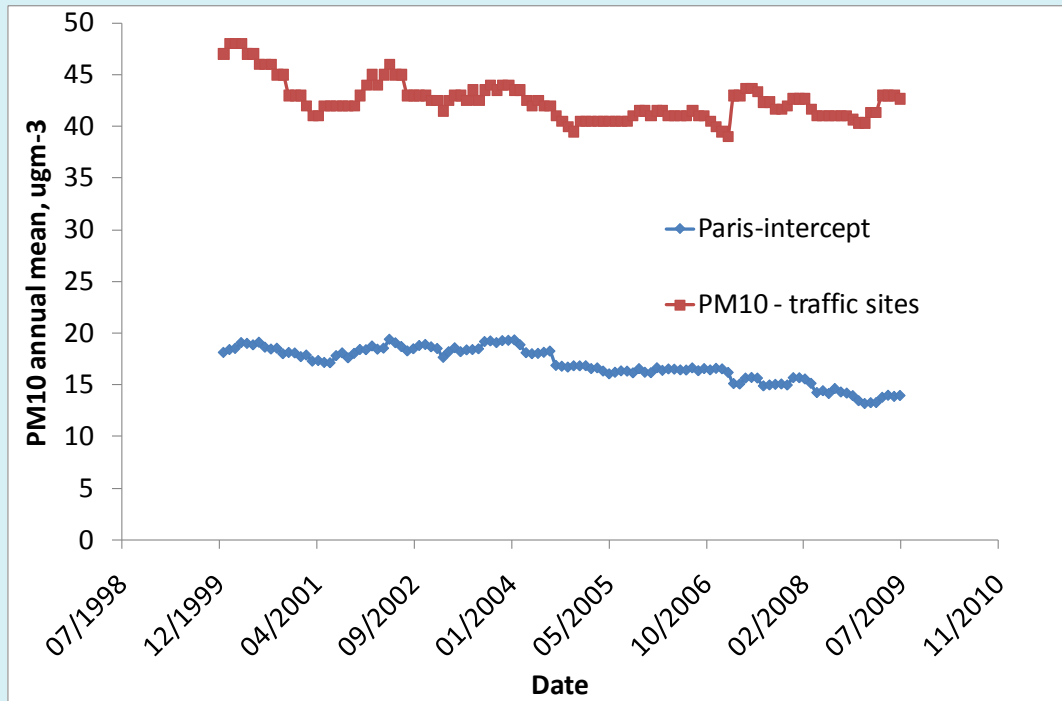
Regional non-primary



- Regional background PM₁₀ has decreased in both London and Paris.
- Regional background PM₁₀ in Paris is greater than London but this difference has diminished since 2004

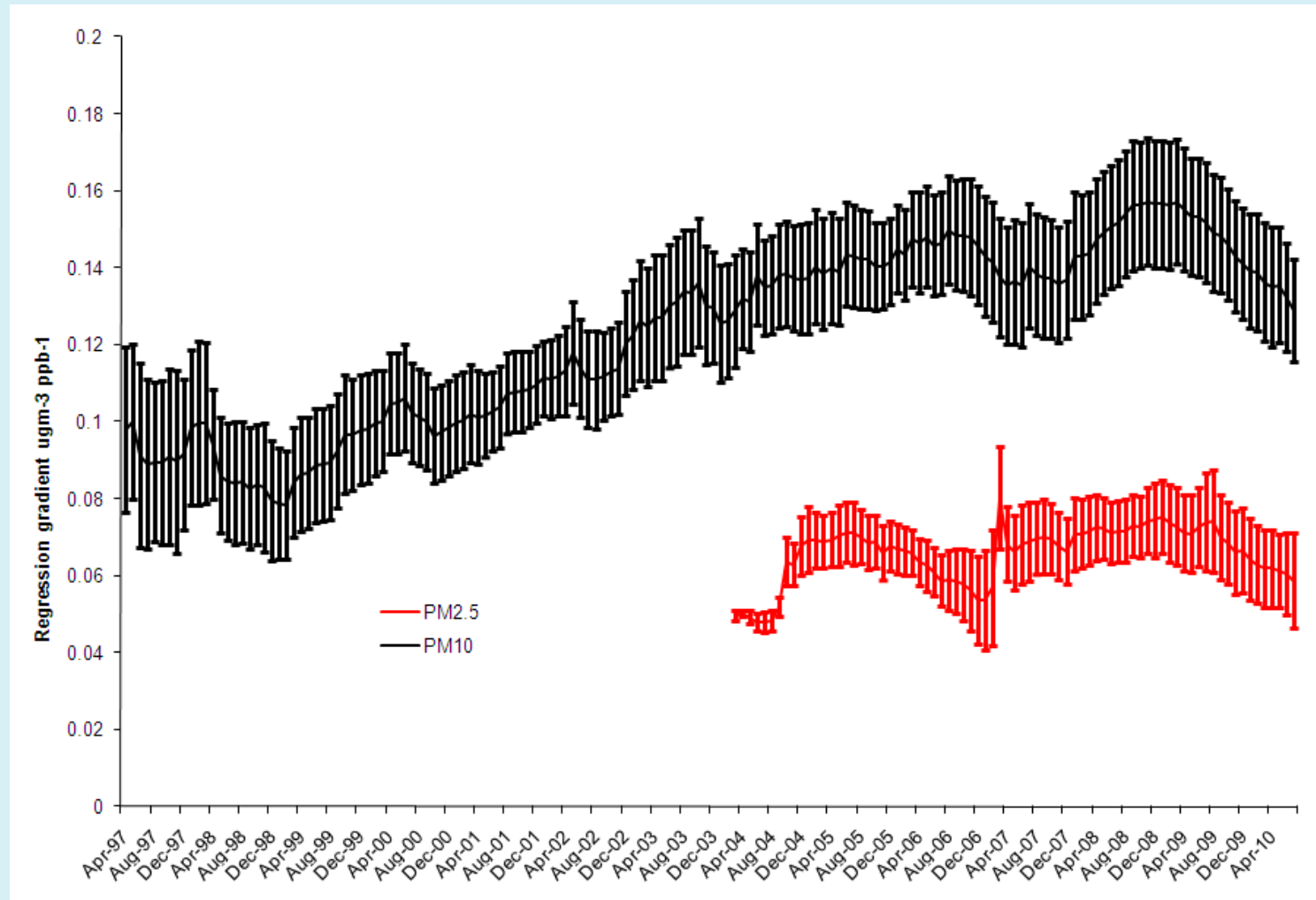
PM₁₀ - effects of Euro emissions standards

Traffic sites in Paris

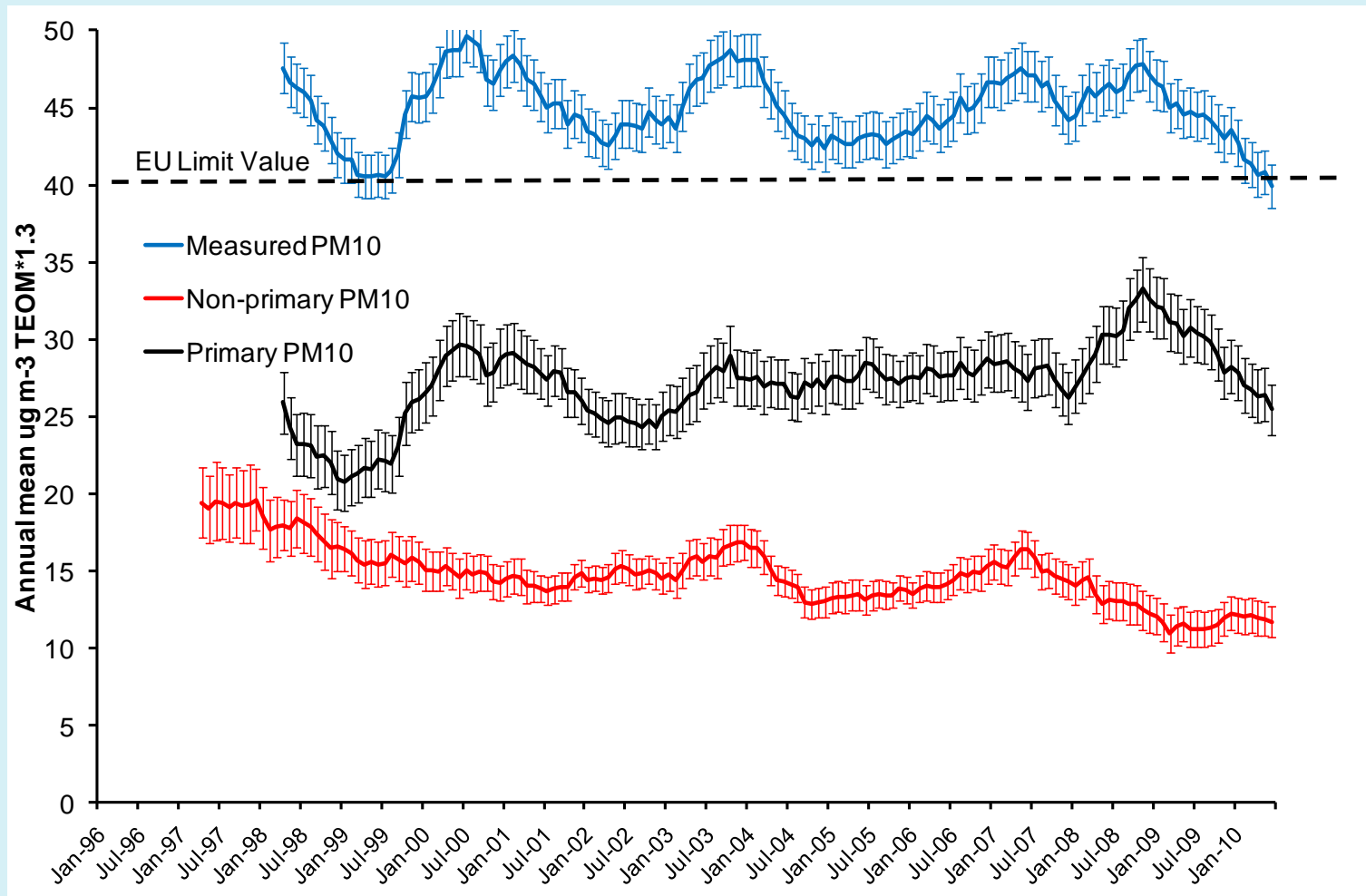


- Paris roadside concentrations have decreased.
- But this was mainly due to decreases in the regional background.
- PM₁₀ from Parisian roads does not show obvious decreases.

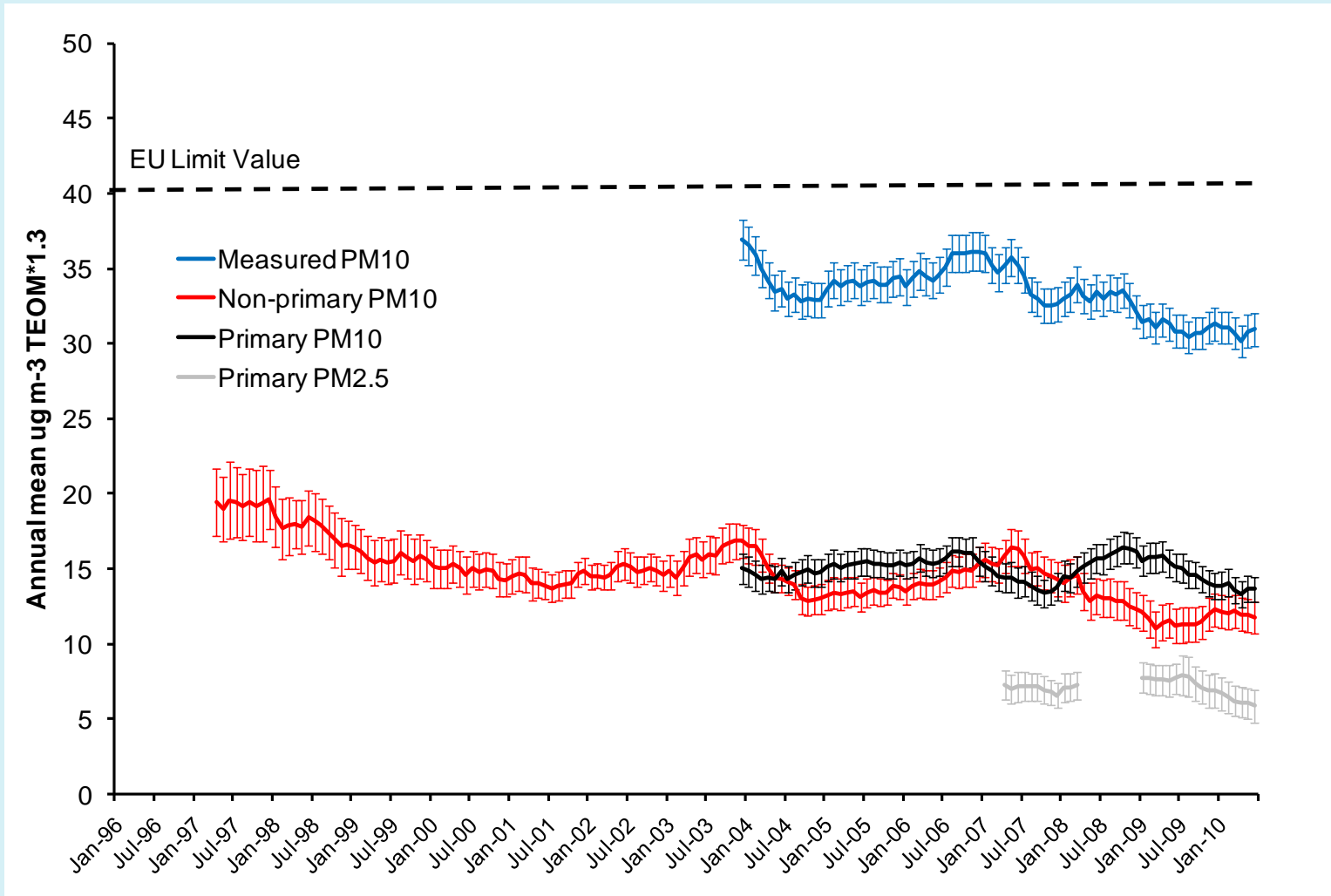
PM₁₀ - effects of Euro emissions standards



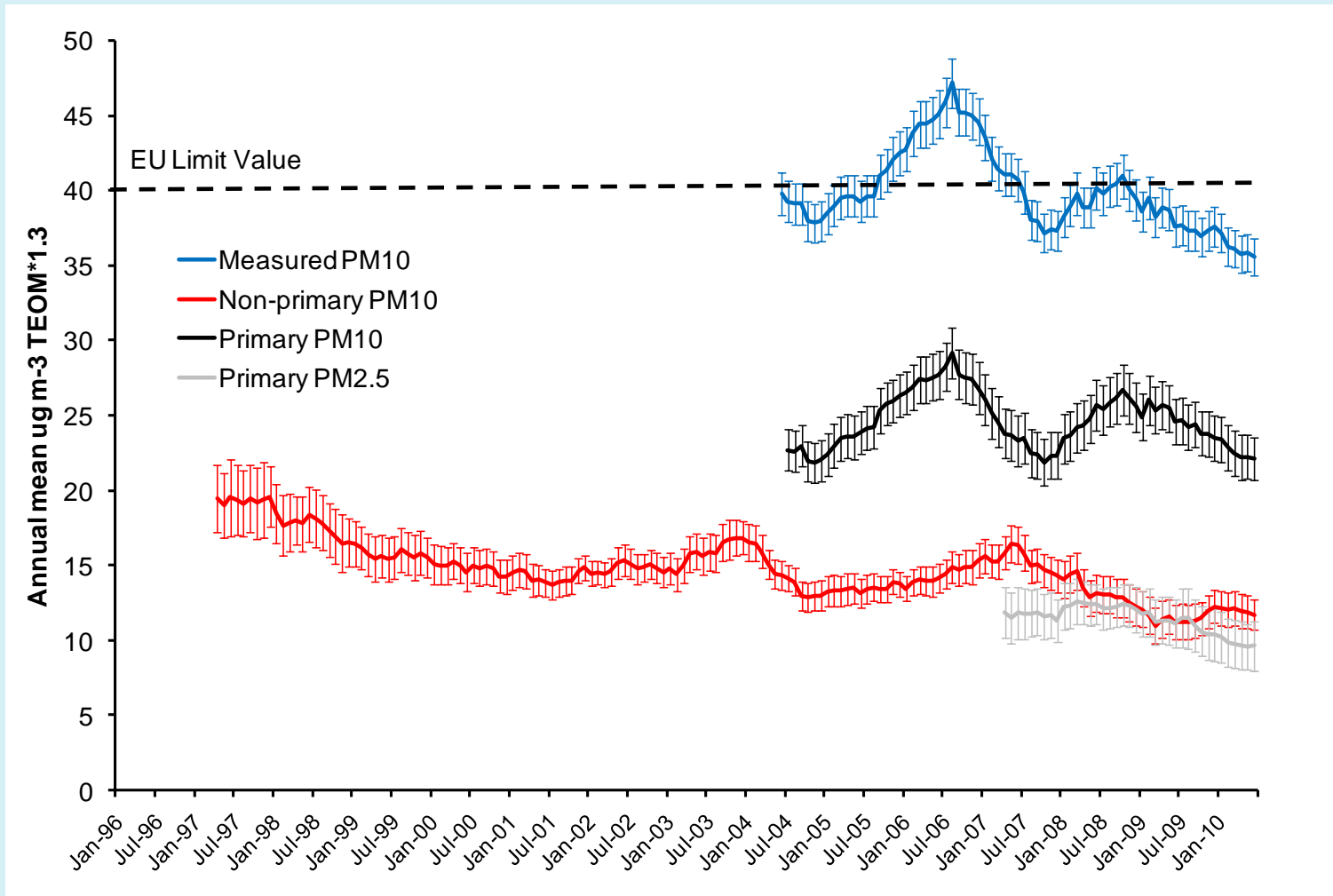
PM₁₀ –source apportionment of concentrations at Marylebone Road



PM₁₀ –source apportionment of concentrations at Old Street

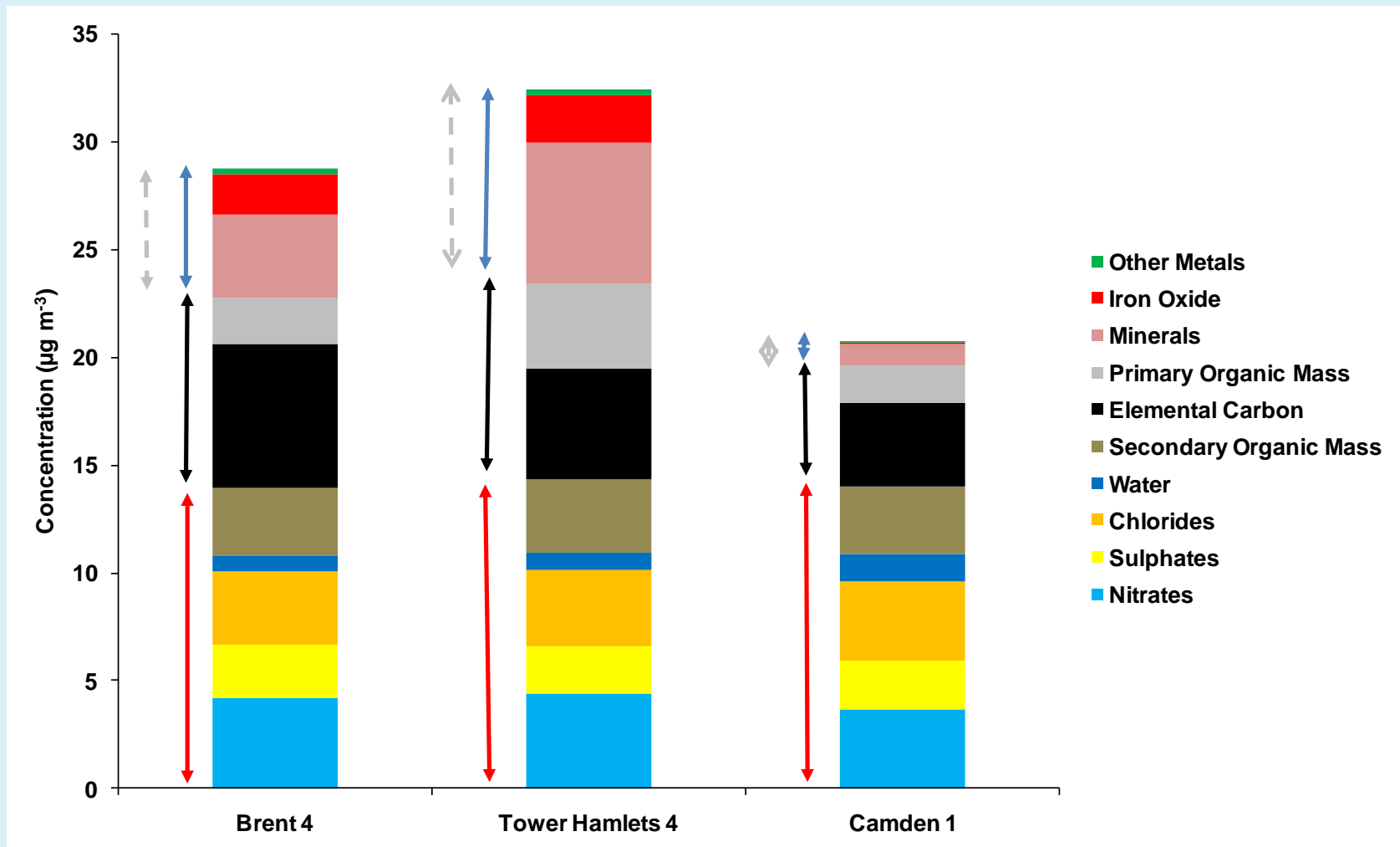


PM₁₀ –source apportionment of concentrations at Brent 4 (N Circular)



New techniques

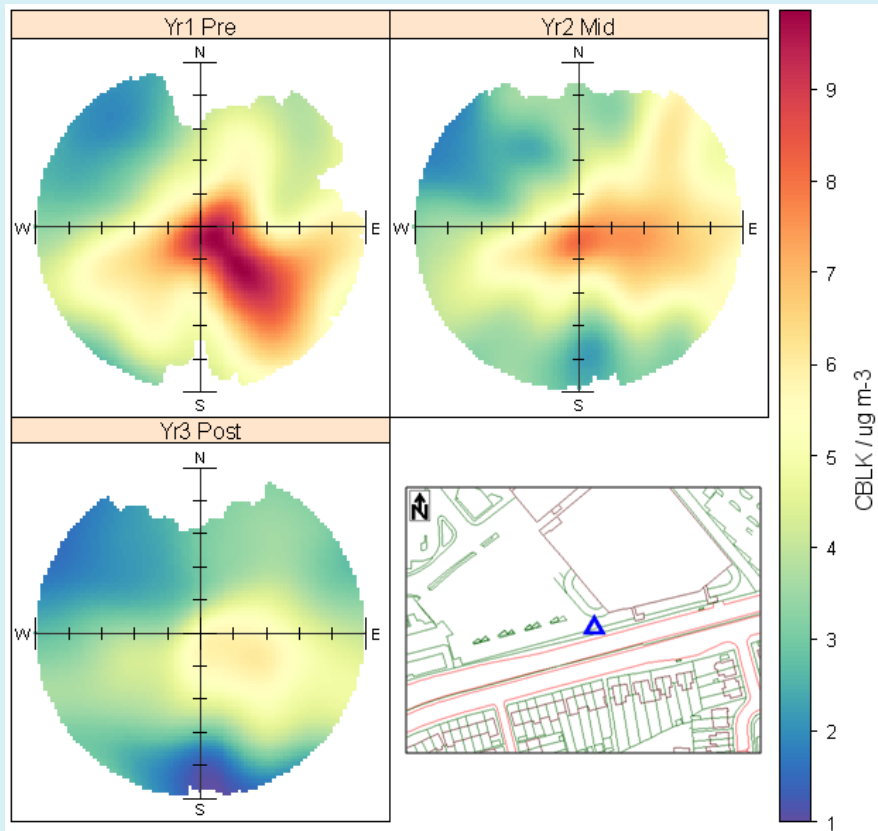
New techniques PM₁₀ – chemical composition



Source: Green *et al*, 2009

New techniques

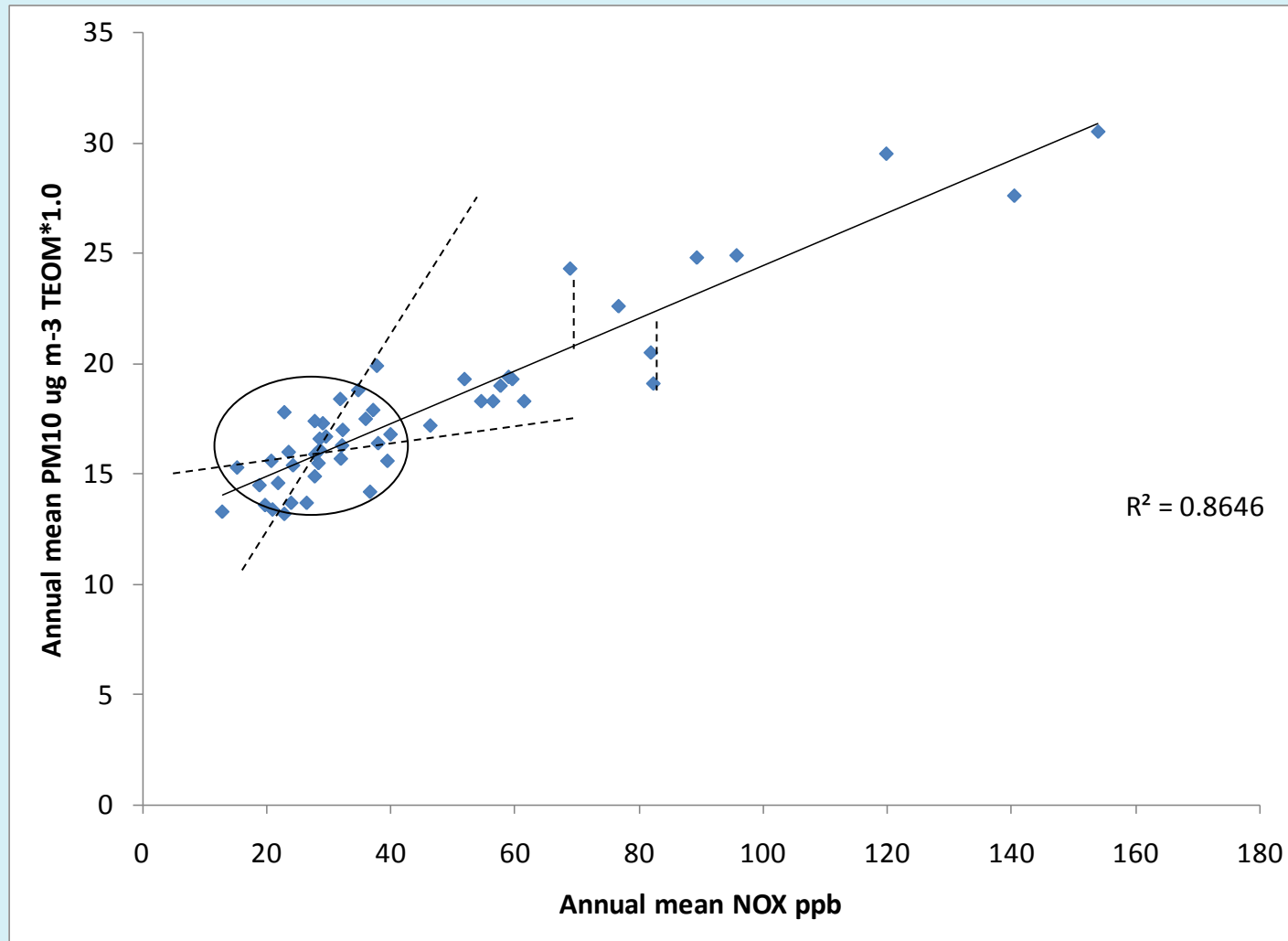
LEZ study - reduction in black carbon at Brent 4



Source: Barratt *et al*, 2009

New techniques

Single site apportionment

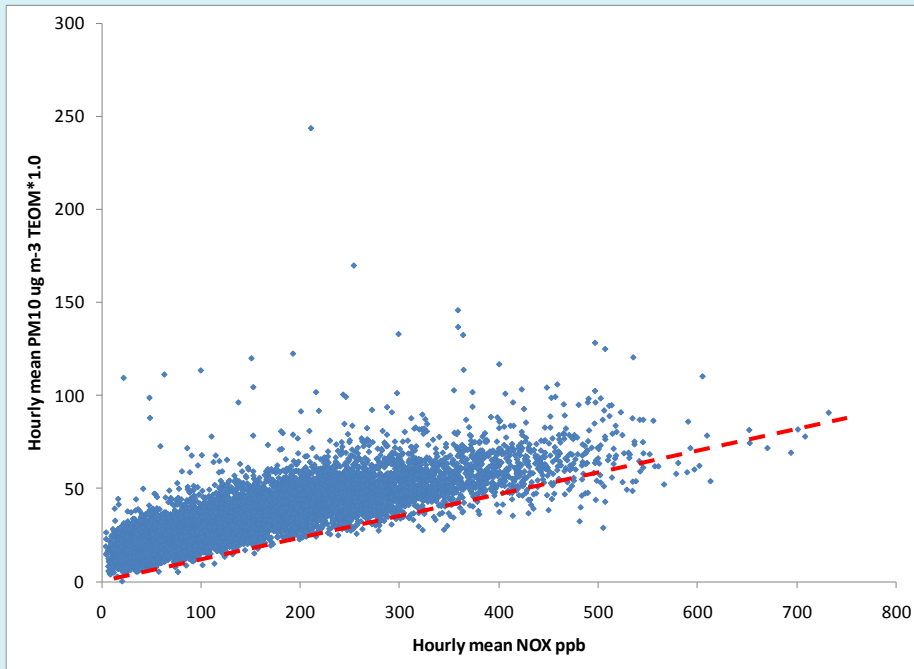


New techniques

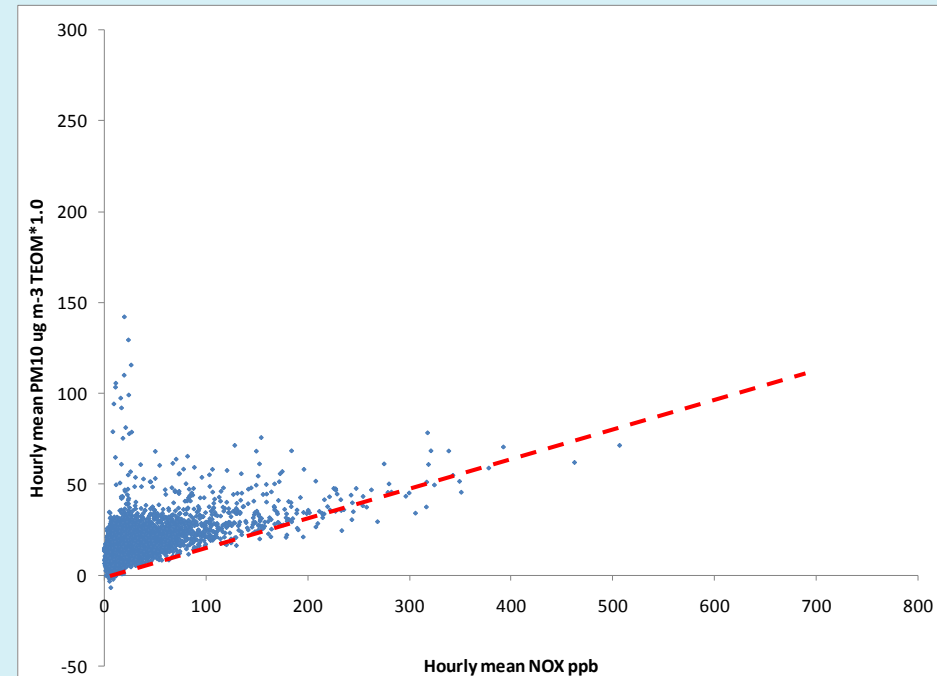
Single site apportionment

(Thanks to Castro et al 1999, Harrison et al 2008)

Marylebone Road

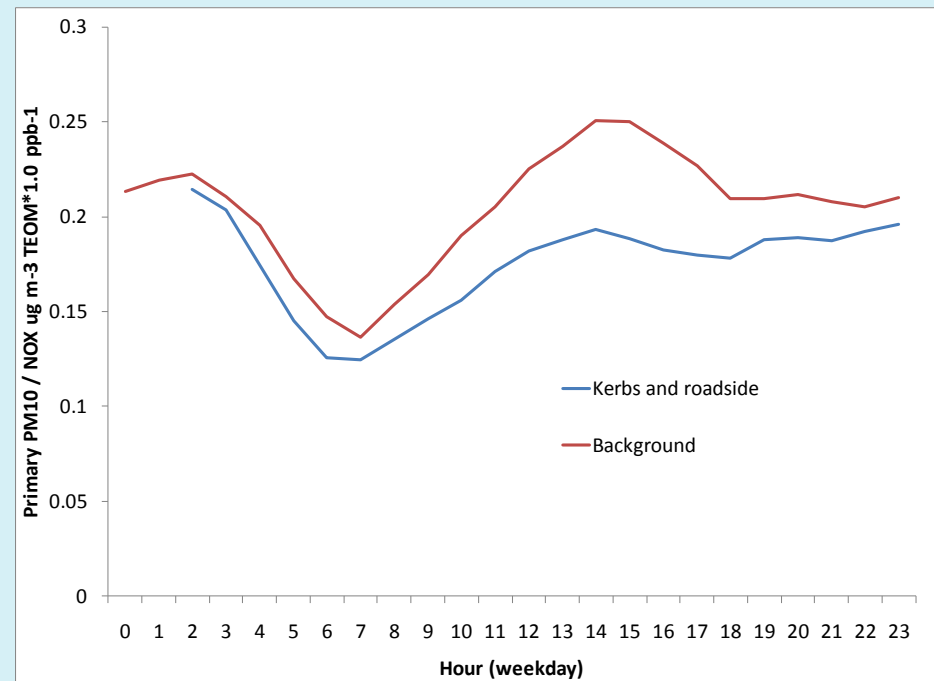
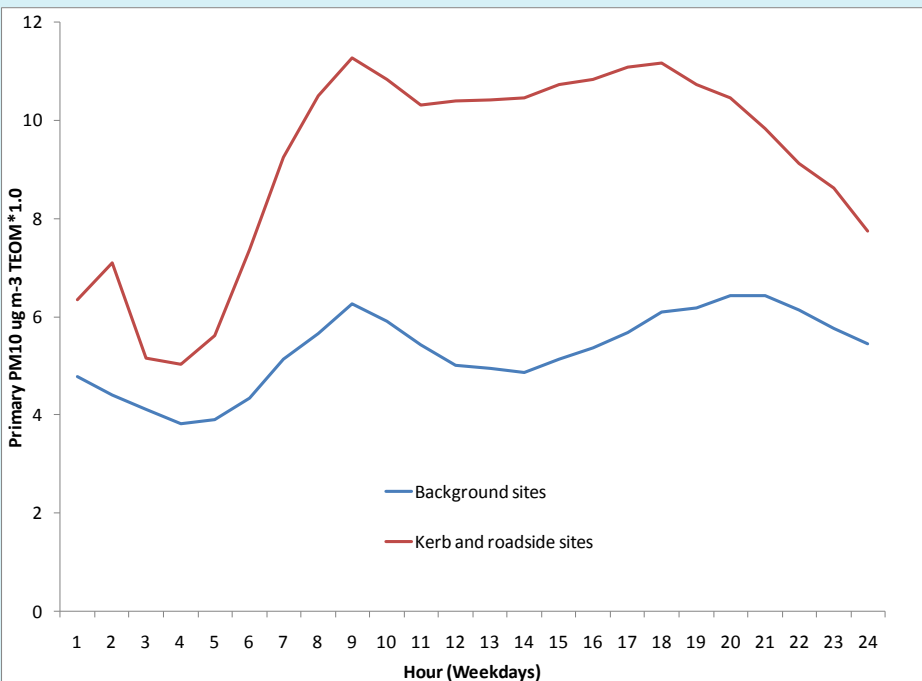


Ealing 7 background



New Techniques

Single site apportionment - diurnal variation in primary PM₁₀



- Background primary PM₁₀ doesn't come from roads only
- Separate background sources have their own emissions profiles - hour/ day/ season
- Emissions inventory suggests PM sources dominated by roads (cf NOX)
- But background PM₁₀ (and PM_{2.5}) source may be proportionately greater than we realise

Conclusions

- Measurements suggest that London is meeting the PM₁₀ LV at the moment
 - (setting aside PM₁₀ close to waste sites and sites affected by local sources that might not conform to EU sitting criteria)
 - Improvement to measurement method (also deduction of sea salt)
 - Decreases in regional PM₁₀
 - Primary PM₁₀
 - No evidence of decreases from London sources prior to ~ 2009
 - Why have Euro emissions abatement not yield decreased PM?
 - Some early evidence of decreased primary PM₁₀ and PM_{2.5} from ~2009?
 - Why? Will it continue?
 - (Linkages between primary PM₁₀ and health effects)

Conclusions

- Further understanding of urban PM is needed for successful policies and abatement.
 - Chemical apportionment (systematic, greater time resolution)
 - Single site apportionment
 - Better linkages between concentrations and local traffic sources
 - Better understanding of background PM sources (biomass, populations exposure, PM_{2.5} exposure reduction)



Thanks to

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Local authorities in London and SE England, defra & TfL

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