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London's air in flux -where are we now ?

2nd July 2015

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(all LAQN partners)

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The current situation and decadal changes in London's air pollution

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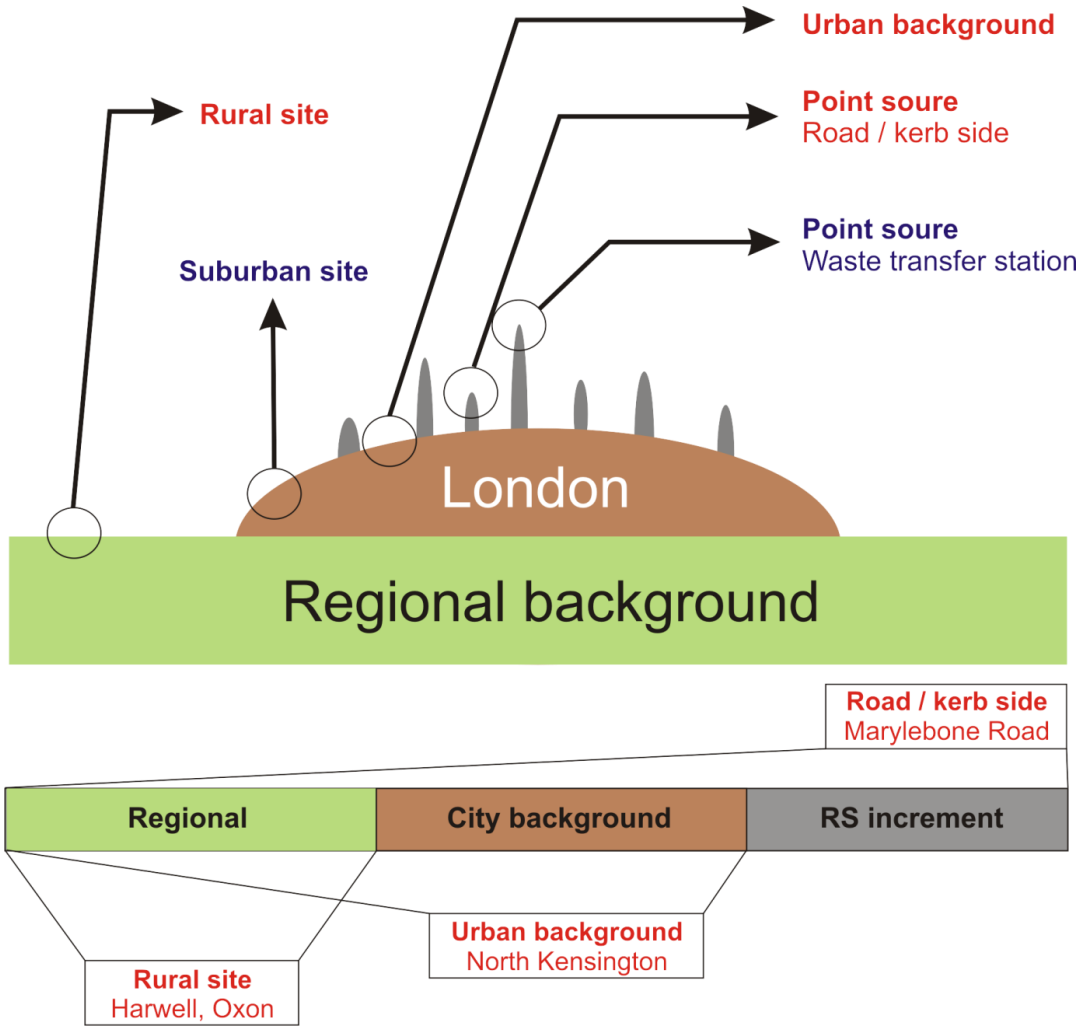
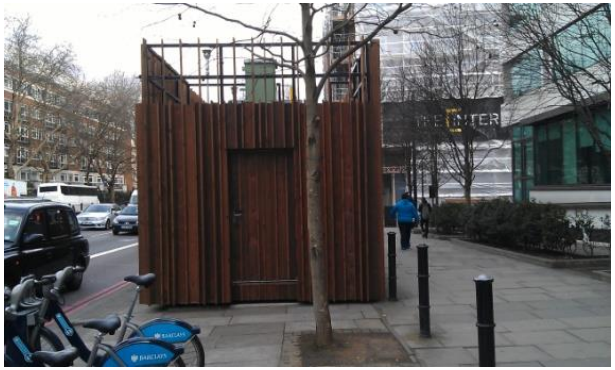
3. Differences in Site Specific Trends

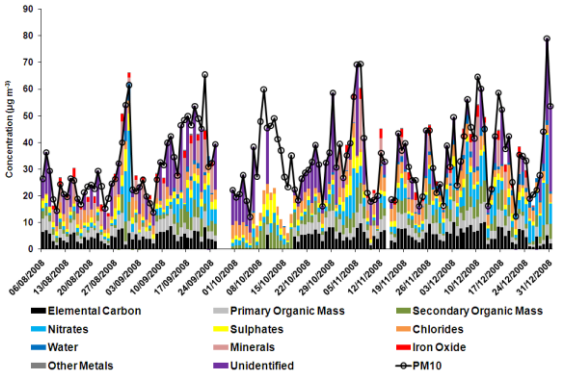
The “Lenschow” perspective

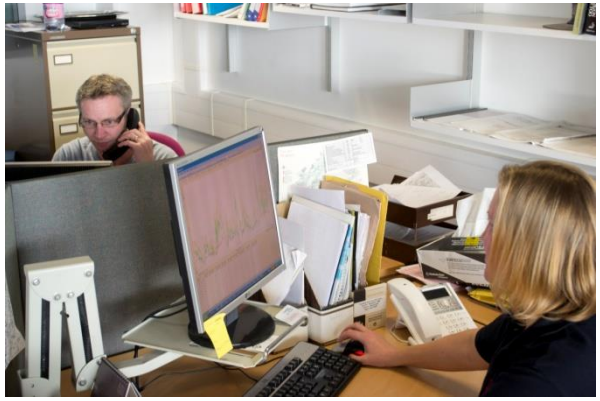
Lenschow et al 2001

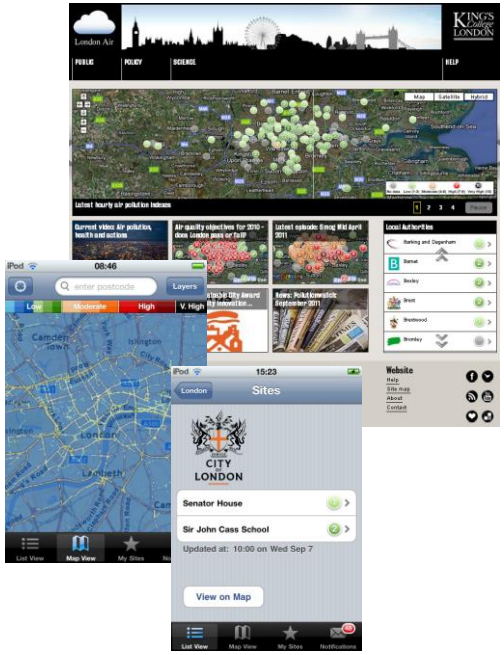


Measuring air pollution in London









Summary LAQN data

- For each pollutant we have summarised measurements in two ways:

1) Trends in long-term measurements sites:
   - Marylebone Road kerbside
   - Inner London roadside
   - Inner London background
   - Outer London roadside
   - Outer London background
2) 2014 measurements against the AQS Objective / EU LV

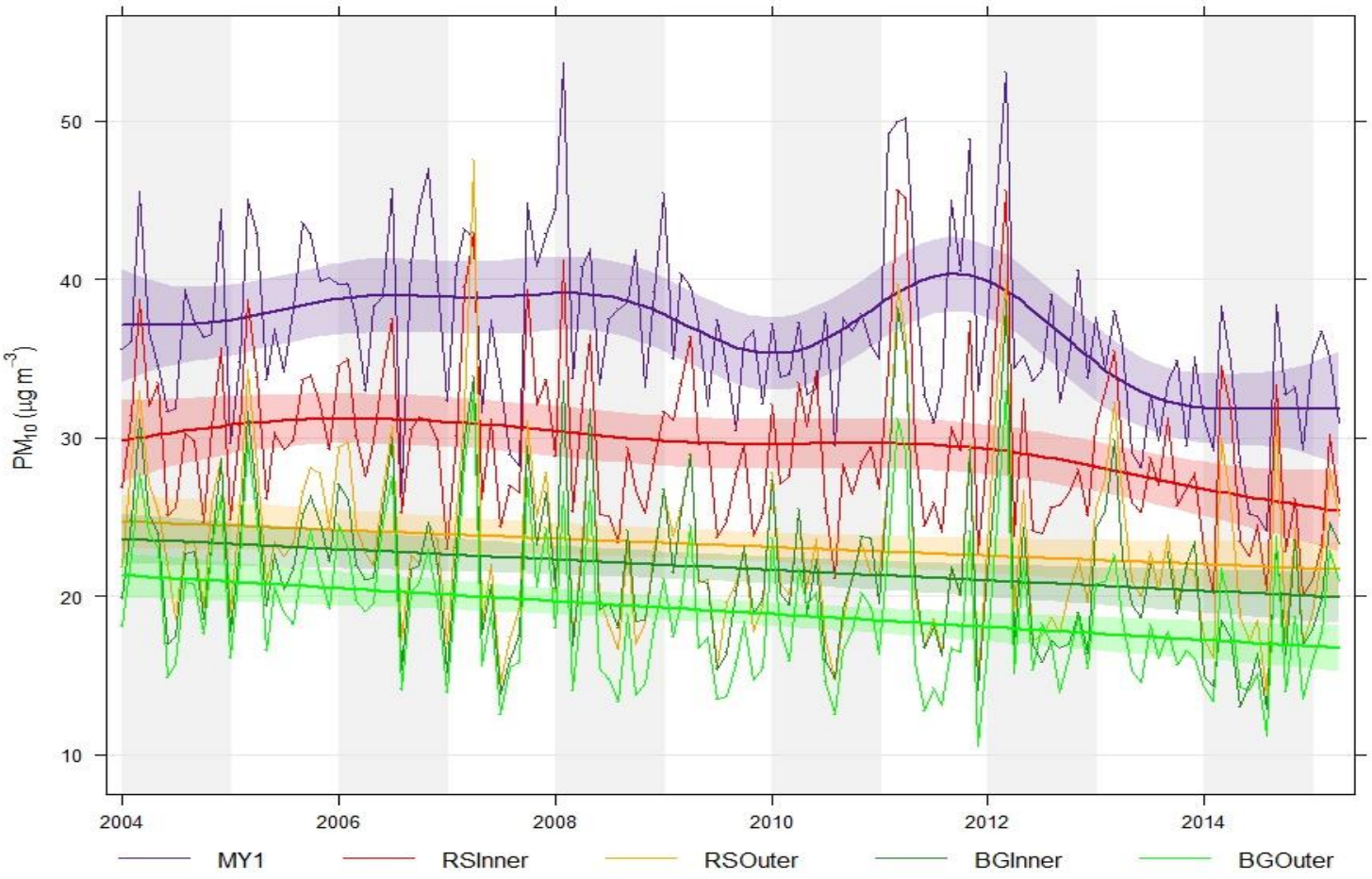
Currently 104 sites in LAQN

- *Note: assessment of EU LV compliance involves more than just the measurements (esp. for PM.) EU LV compliance assessment is a Defra responsibility.*
- *Some provisional data and analysis included.*

PM_{10}

Trends only possible since 2004 – first date that the VCM could be operated.

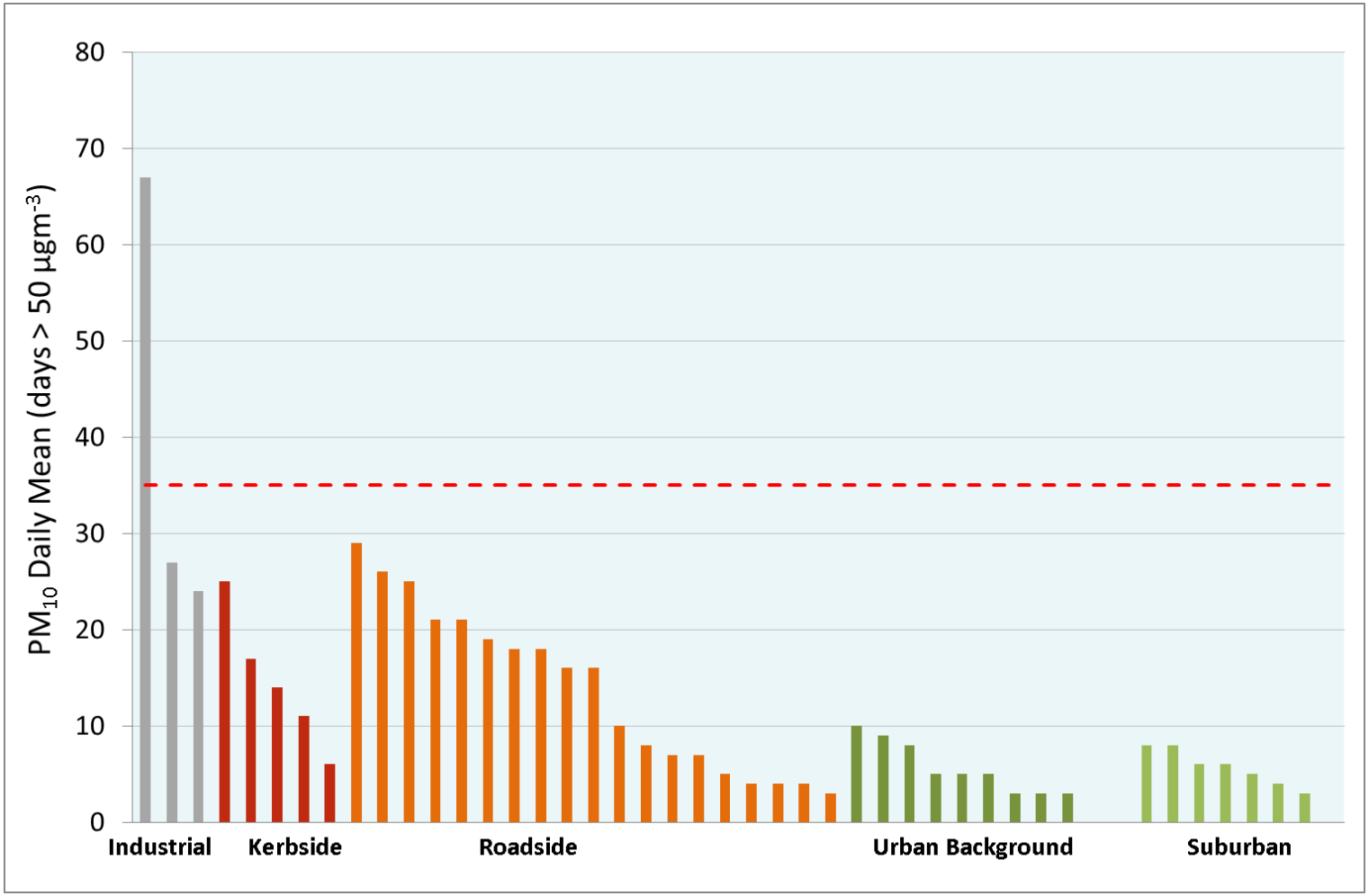
Probable that changes in the regional background are driving the apparent decrease in PM across site types.



PM_{10}

2014 vs the AQS objective / EU LV

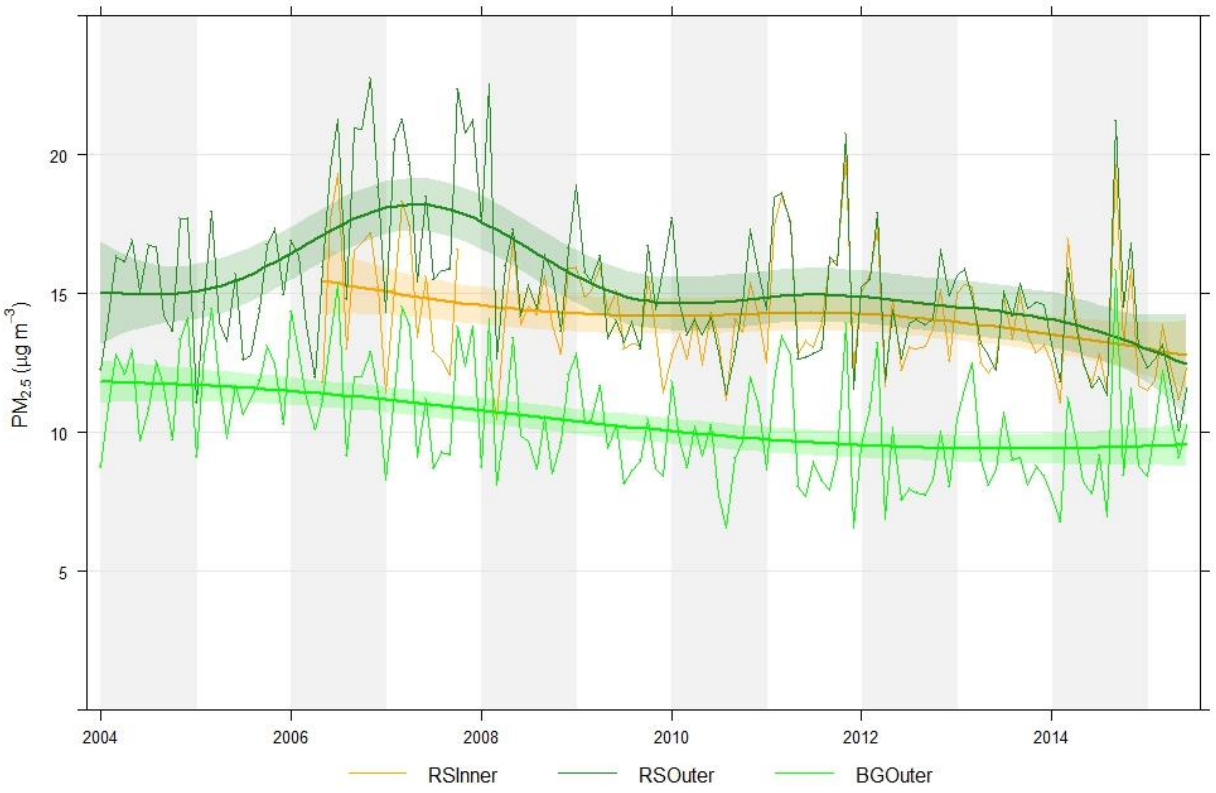
Only sites that achieved 90% data capture included.



$PM_{2.5}$ (ish)

Changes in measurement methods and historic small numbers of monitoring sites make trends difficult.

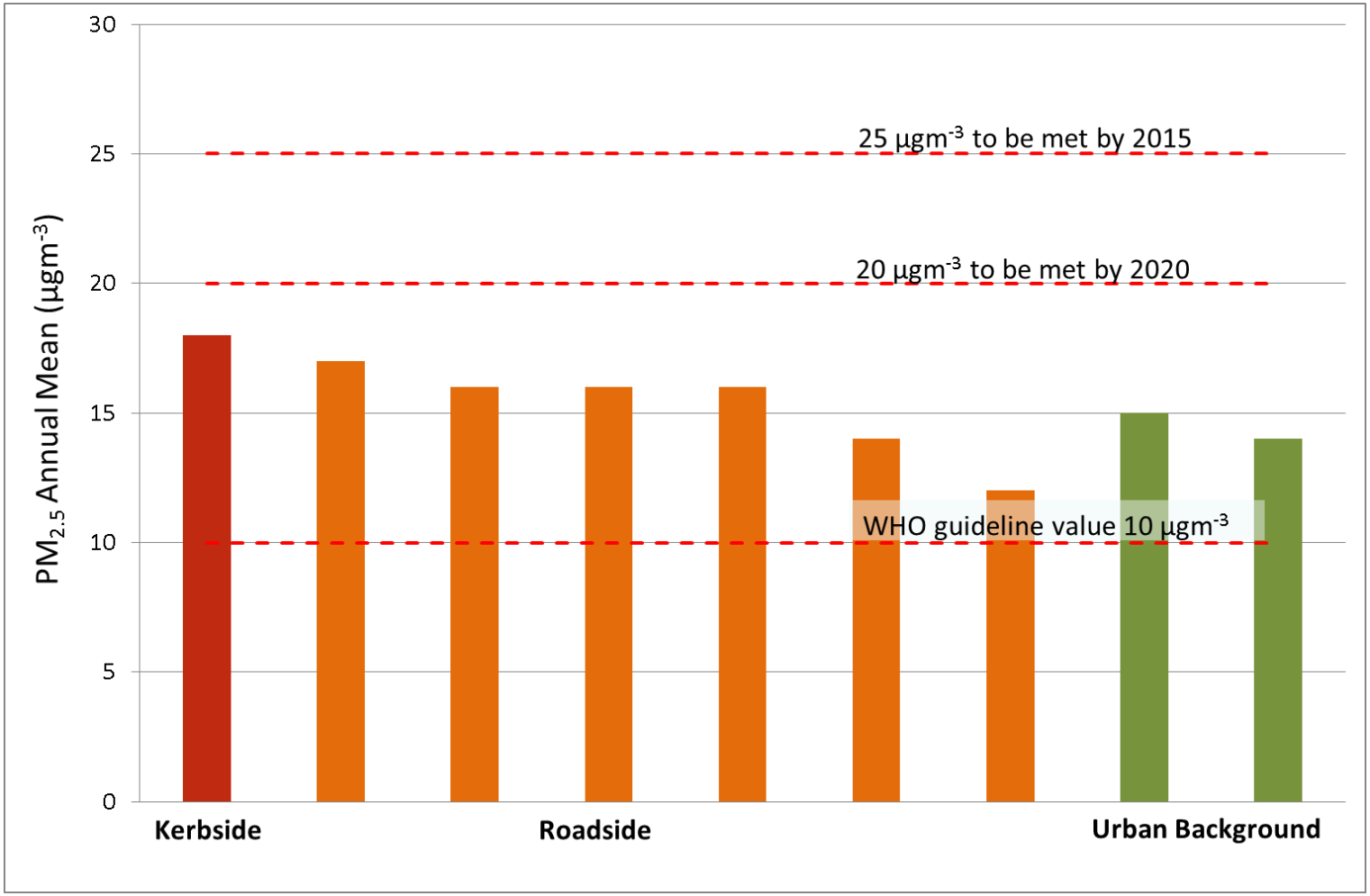
TEOM measurement sites only shown (Not reference equivalent)



$PM_{2.5}$

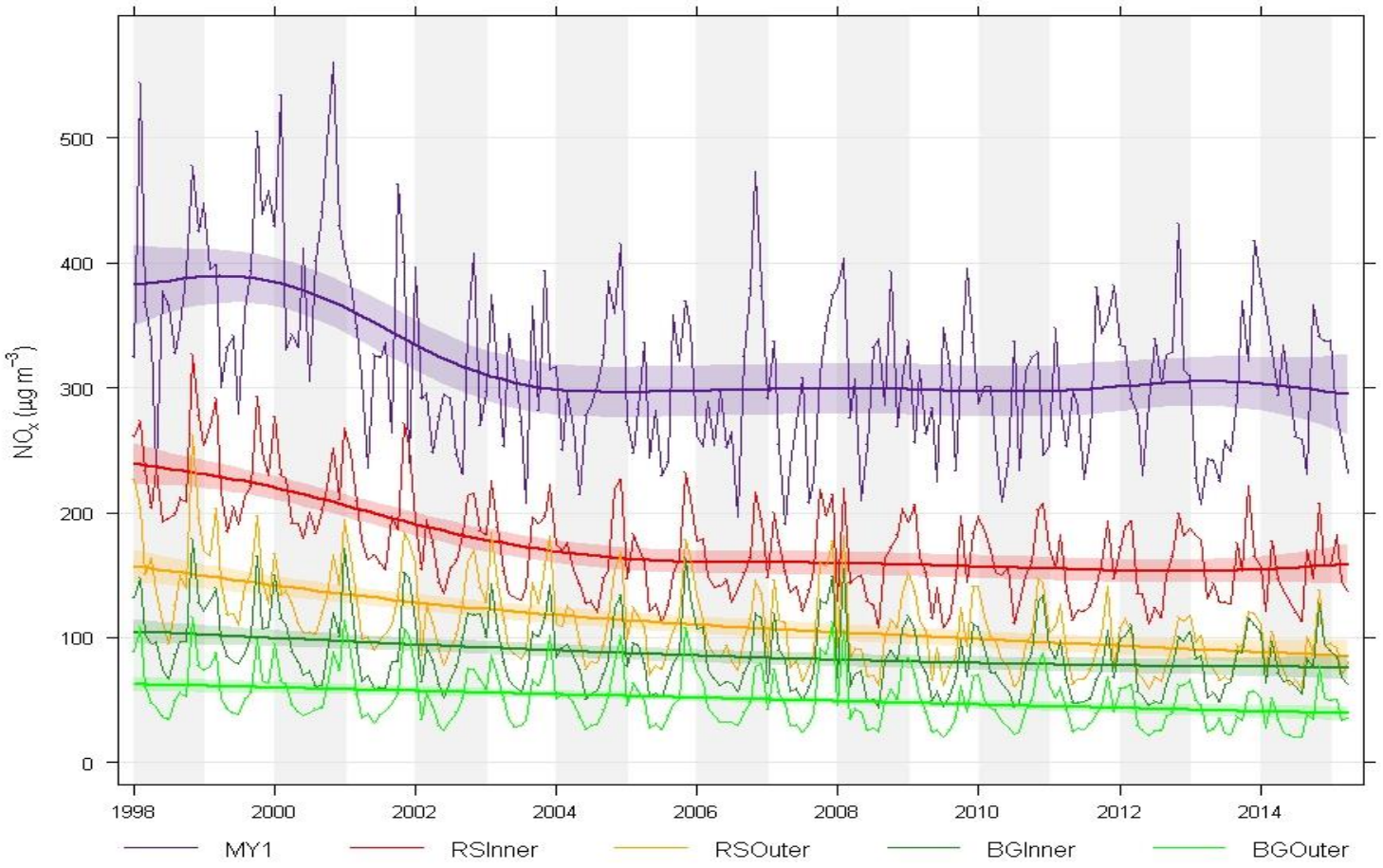
FDMS measurements only (Reference Equivalent)

2015 will see some new SMART BAMs



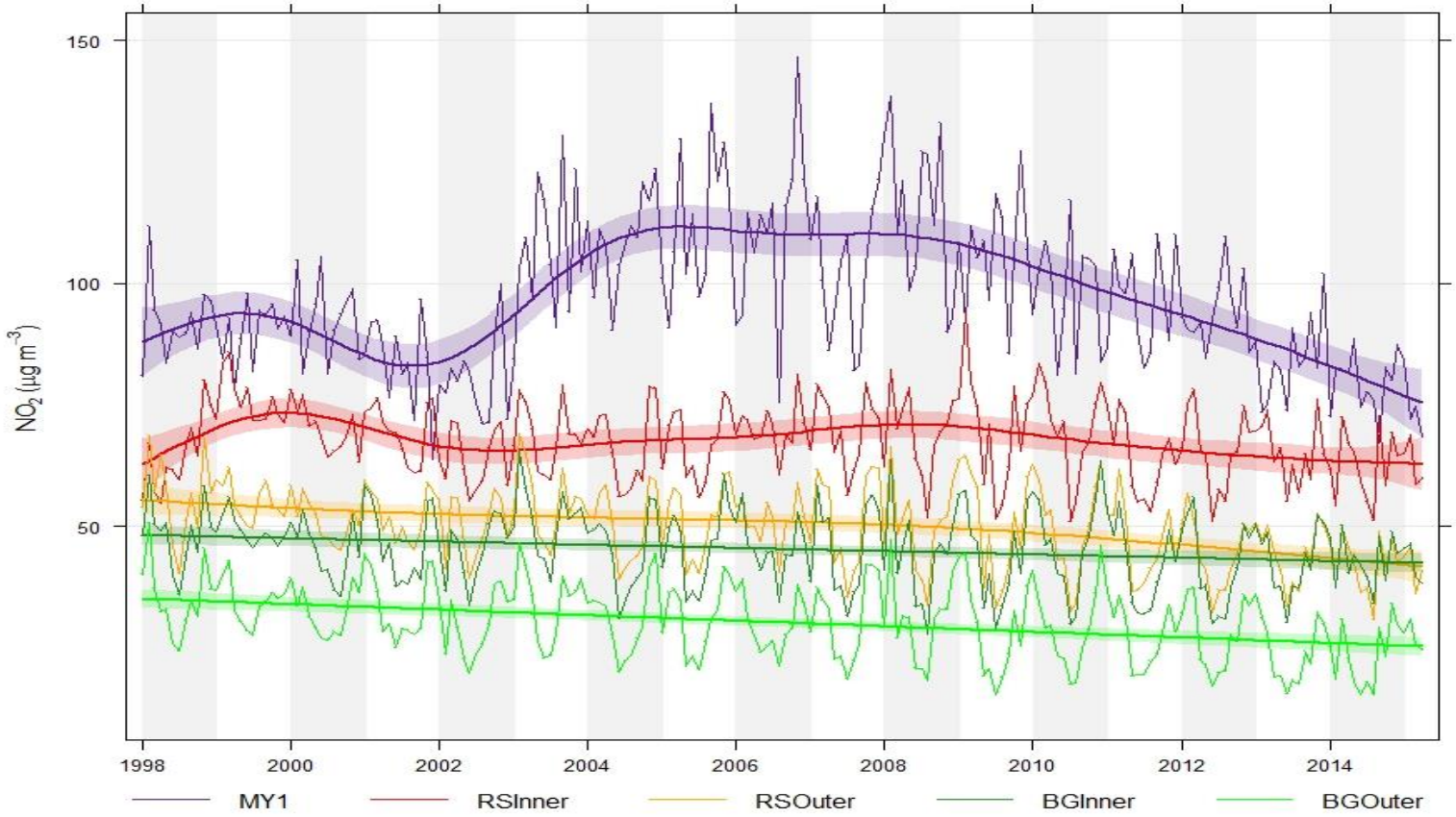
NO_X

Primary pollutant ($NO+NO_2$) tells us about emissions related to NO_2.
Decreases to ~2002/3 and relative stability since



NO_2

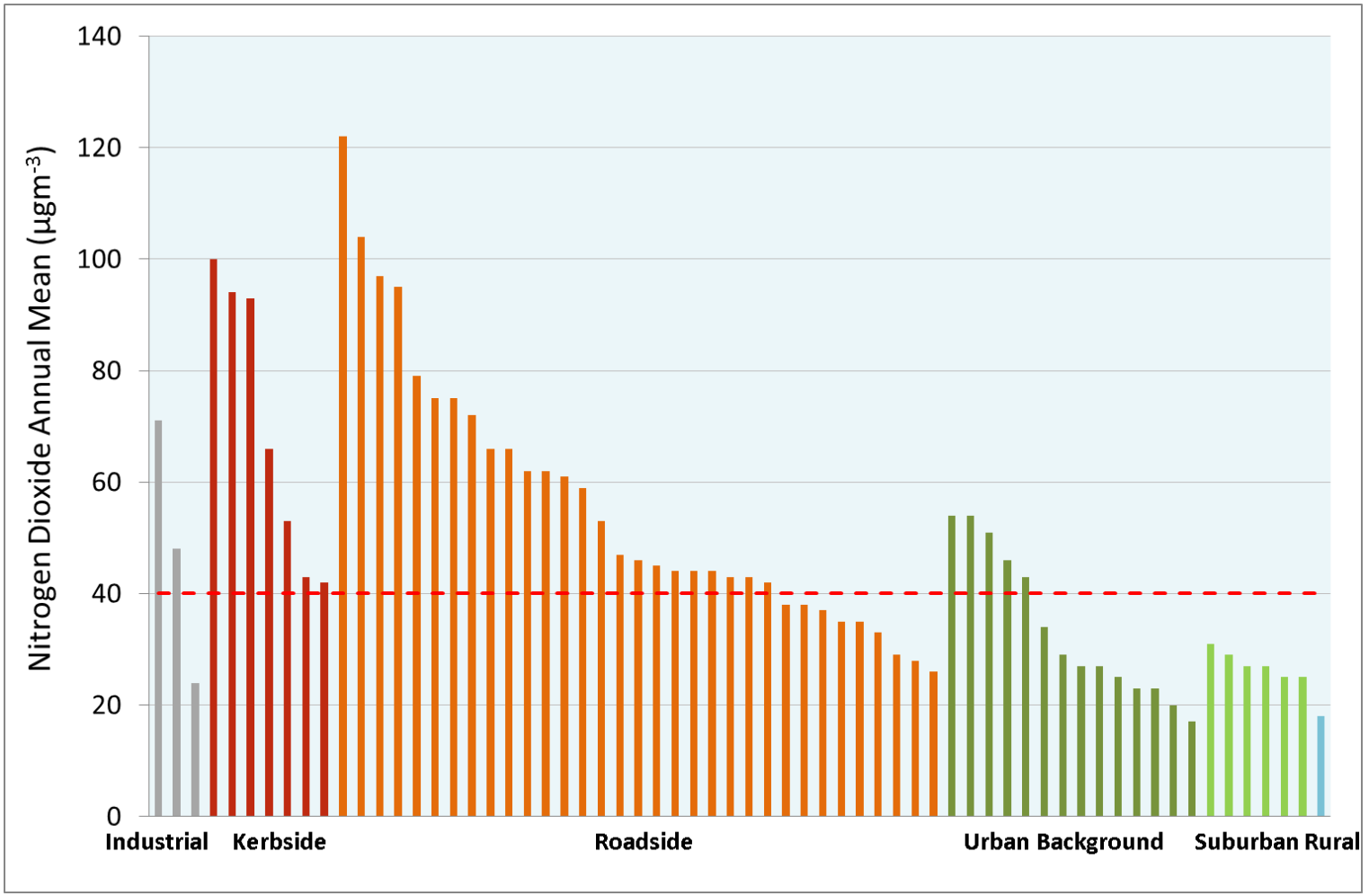
Some evidence that roadside is reflecting slow decrease seen at background.



NO_2

Widespread breaches of the AQS Objective and possibly EU LV(?)

Some roadside exceed by more than 2-3x

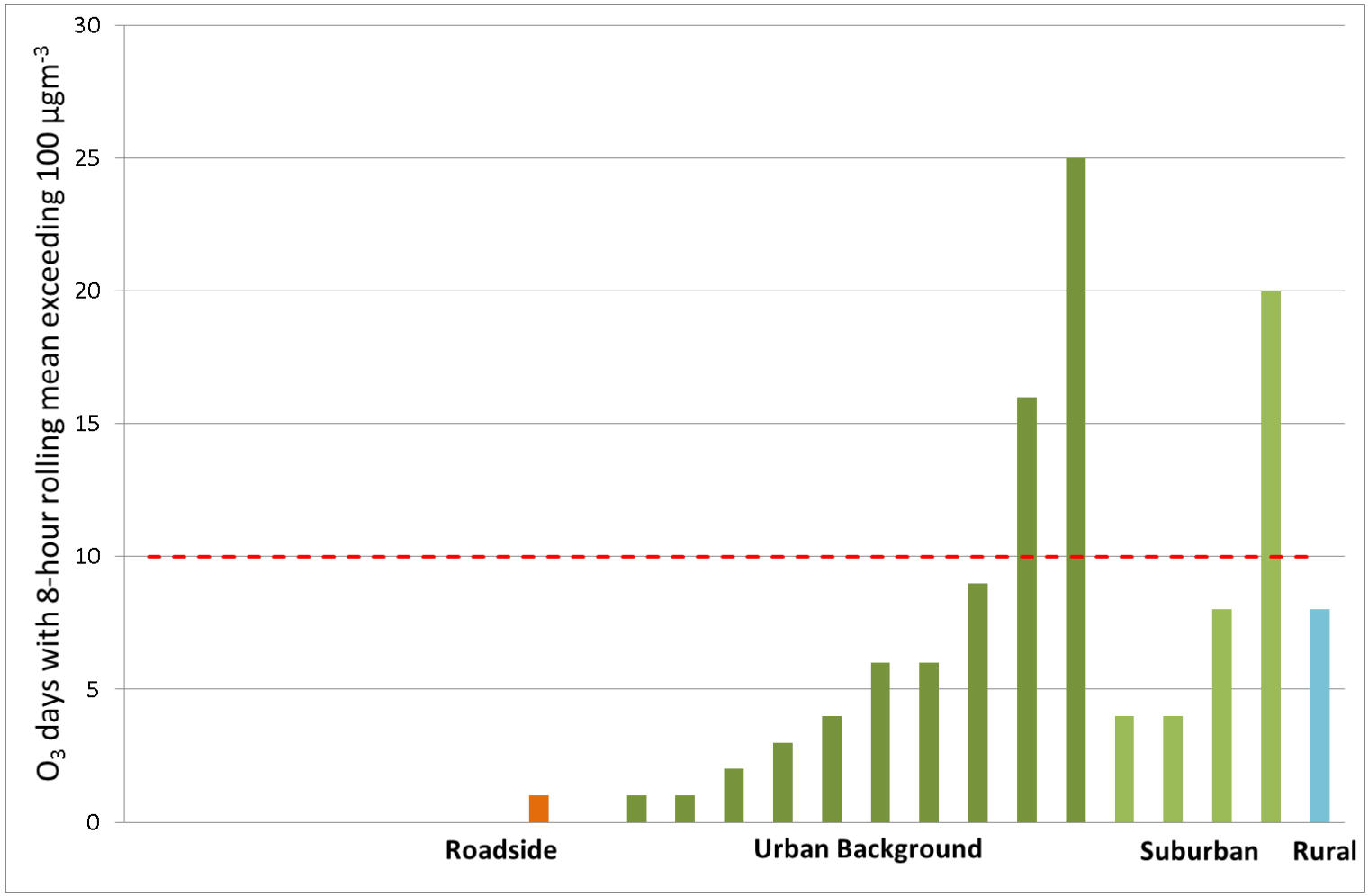


O_3

Some breaches of the AQS Objective but not nearly as widespread as previous years.

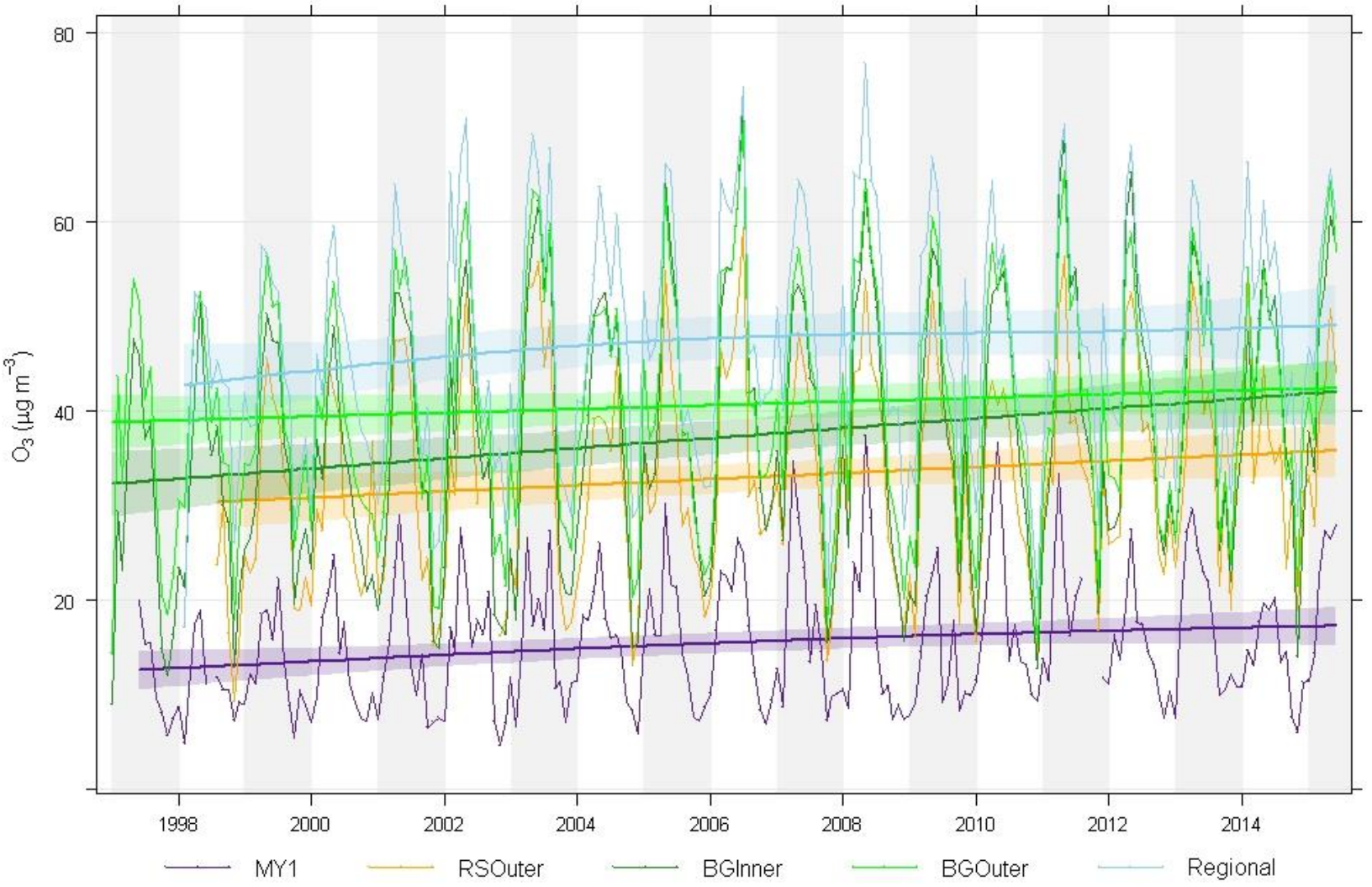
Many sites measured 30 – 40 days with max 8h > 100 ugm^{-3} in 2008.

Reflection of quality of “summers” ?.



O_3

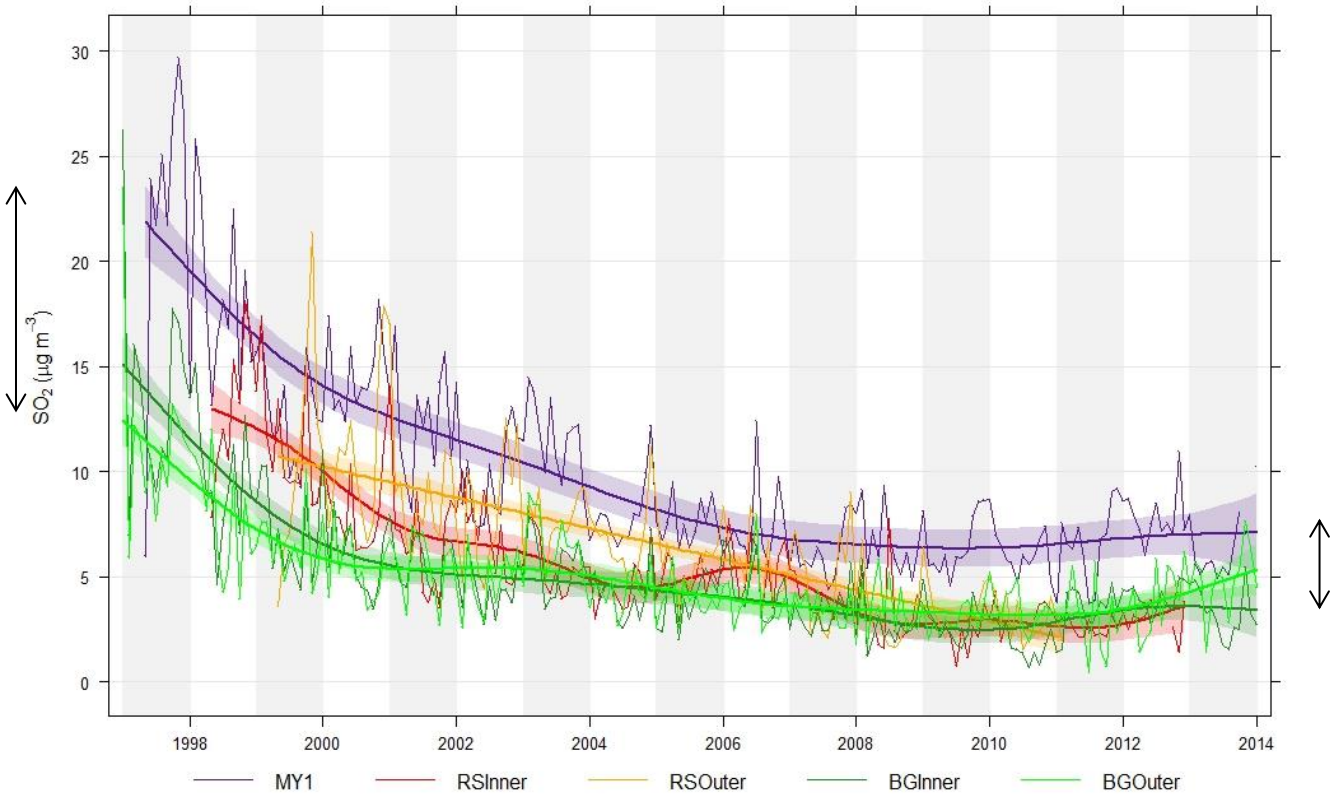
Decrease in London decrement as observed by AQEG (2009)



SO_2

Improvements in industrial emissions and S content of fuel (2007)

Only one RS Inner site by end - important we retain some monitoring



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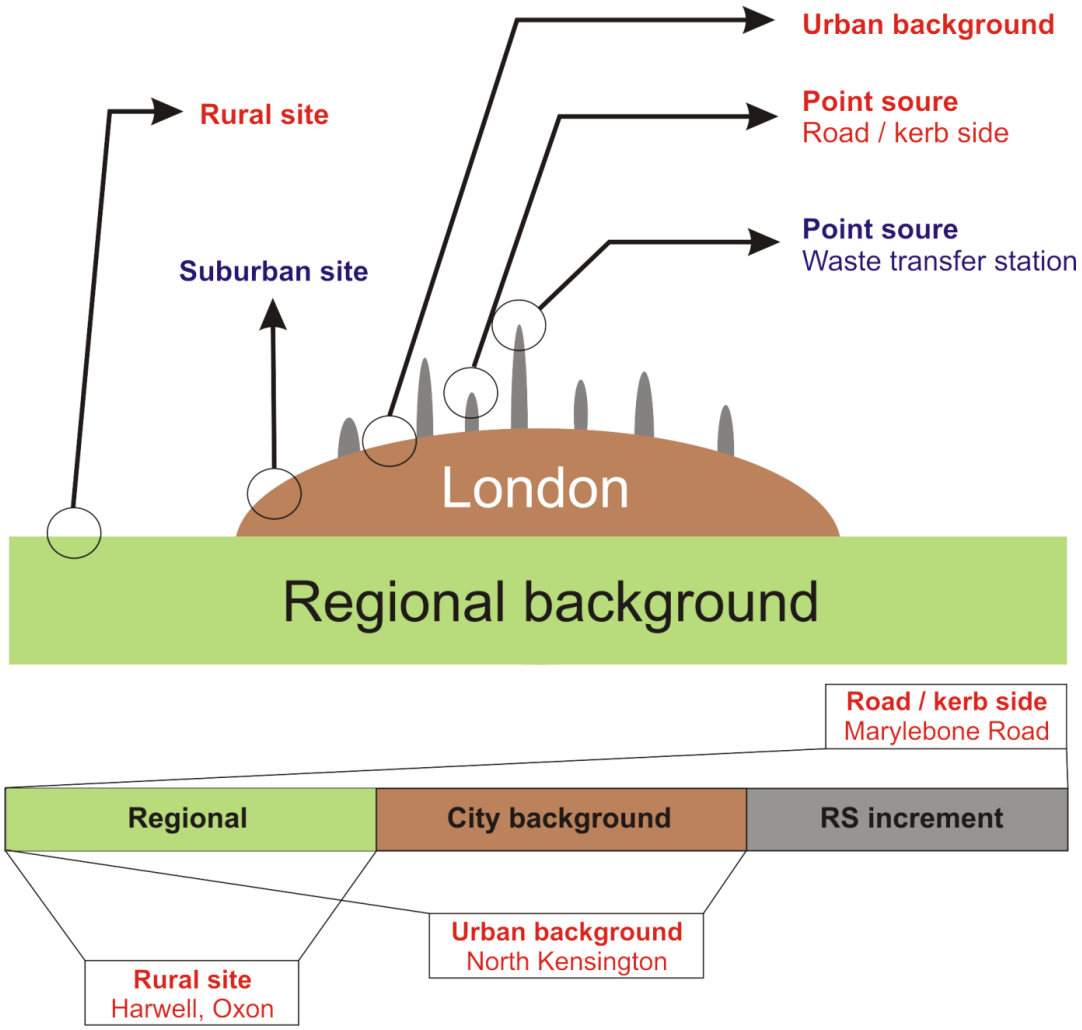


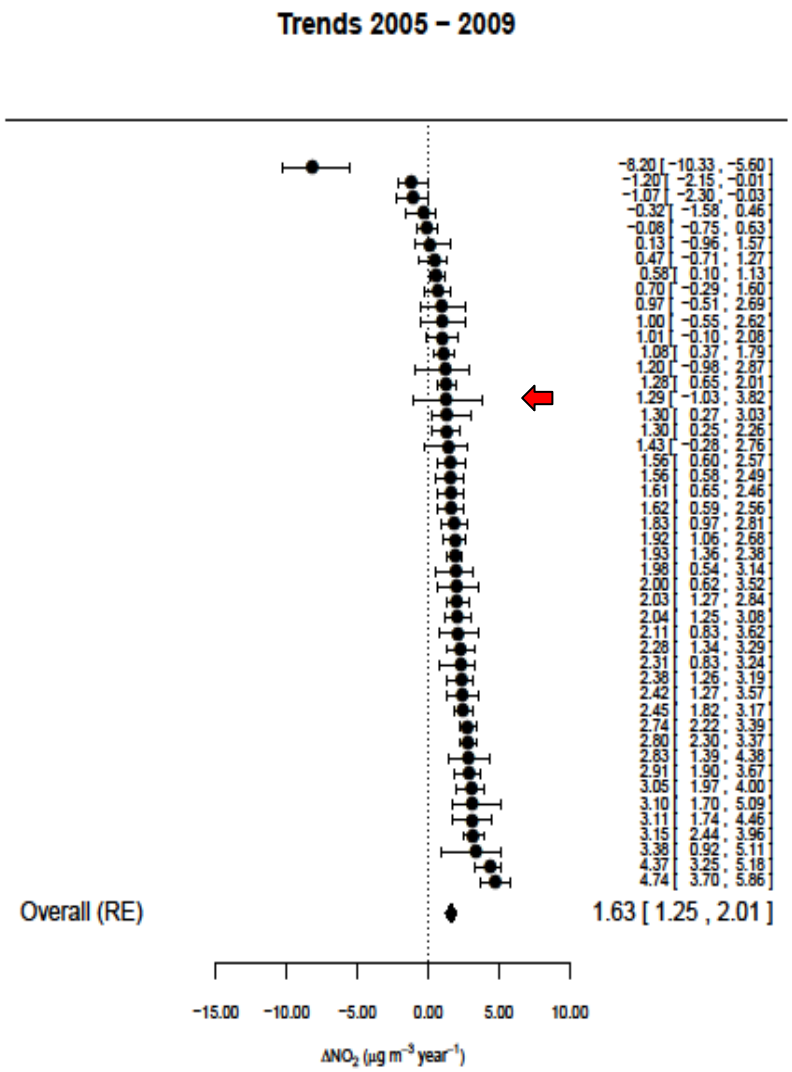
Site specific trend data

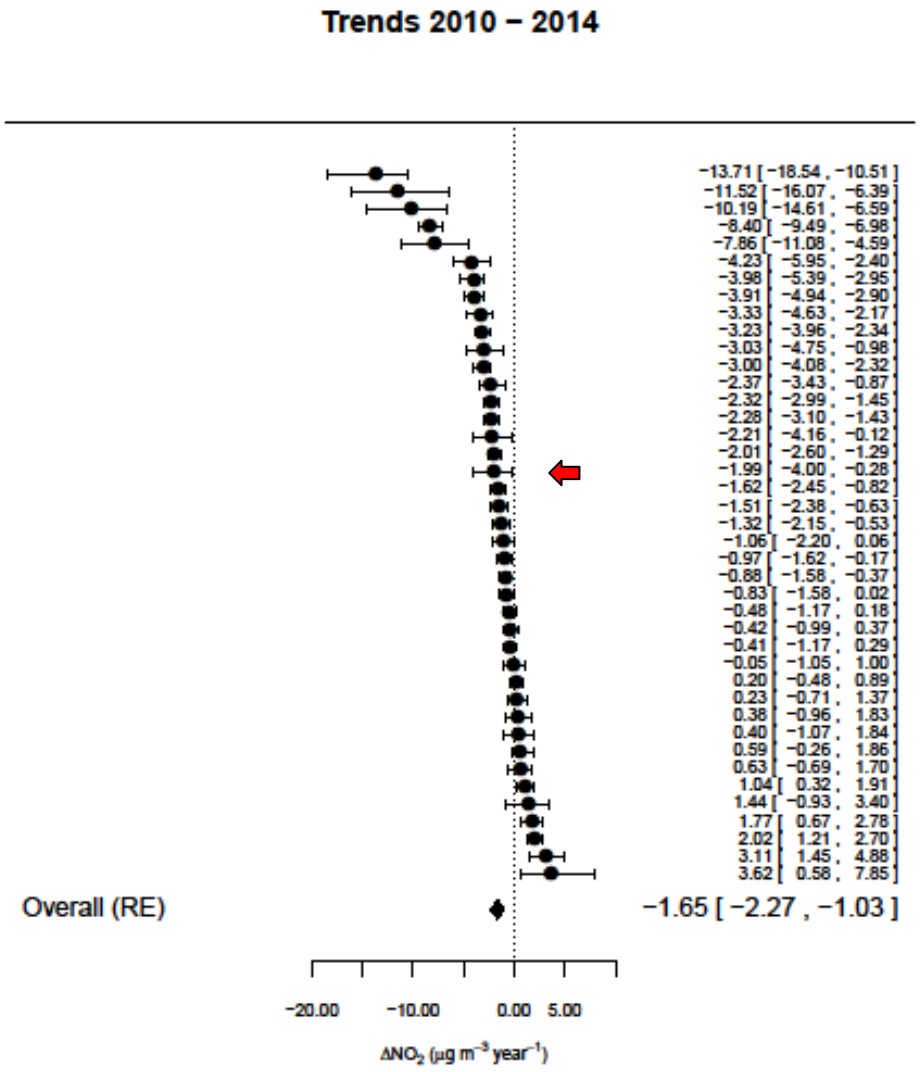
- By looking at difference in site trends we hope to find what changes are making a difference in real world (project with TfL)
- For each roadside site we have looked at the trend in road contribution:

1) 2004-2009
2) 2010-2014

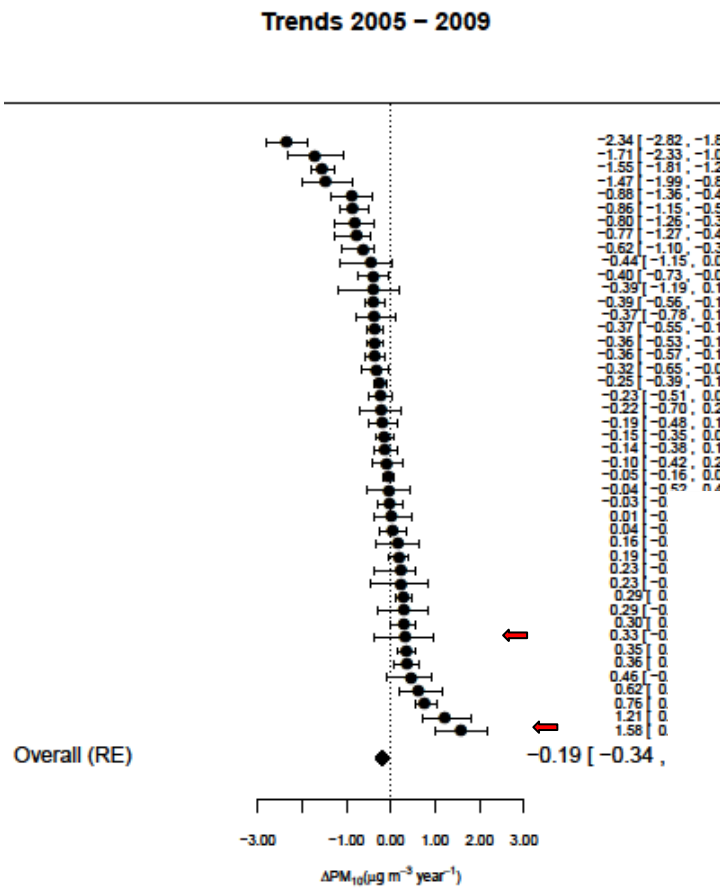
- Forest plots for
- NO_X, NO_2
- PM_{10}, $PM_{2.5}$ (2010-2014 only)

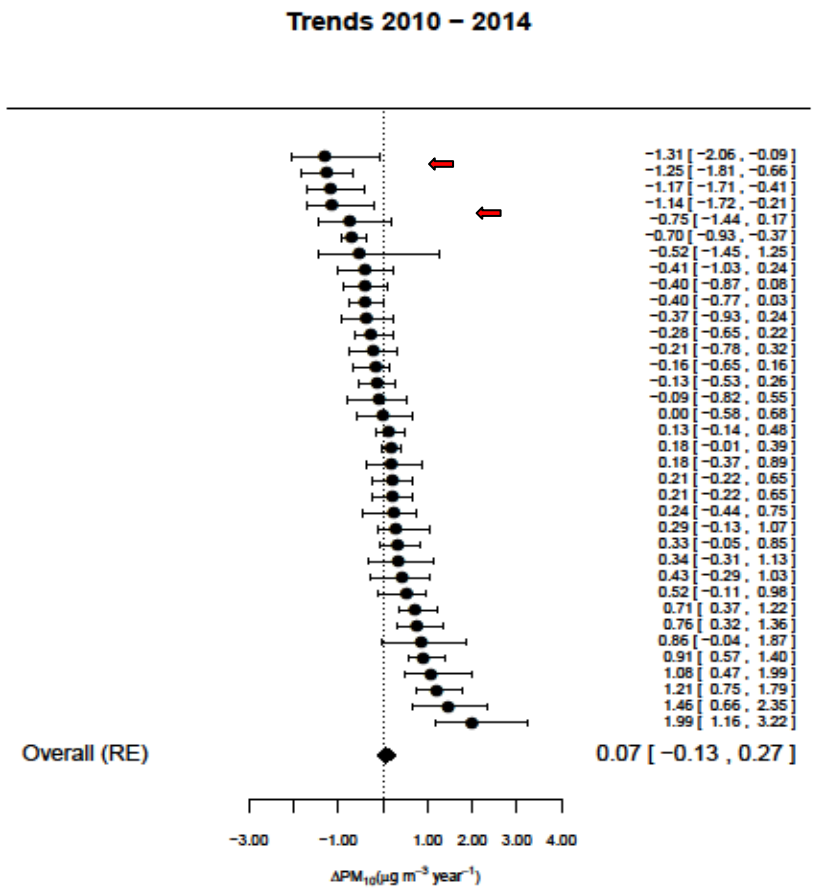
NO_2 trends at specific sites



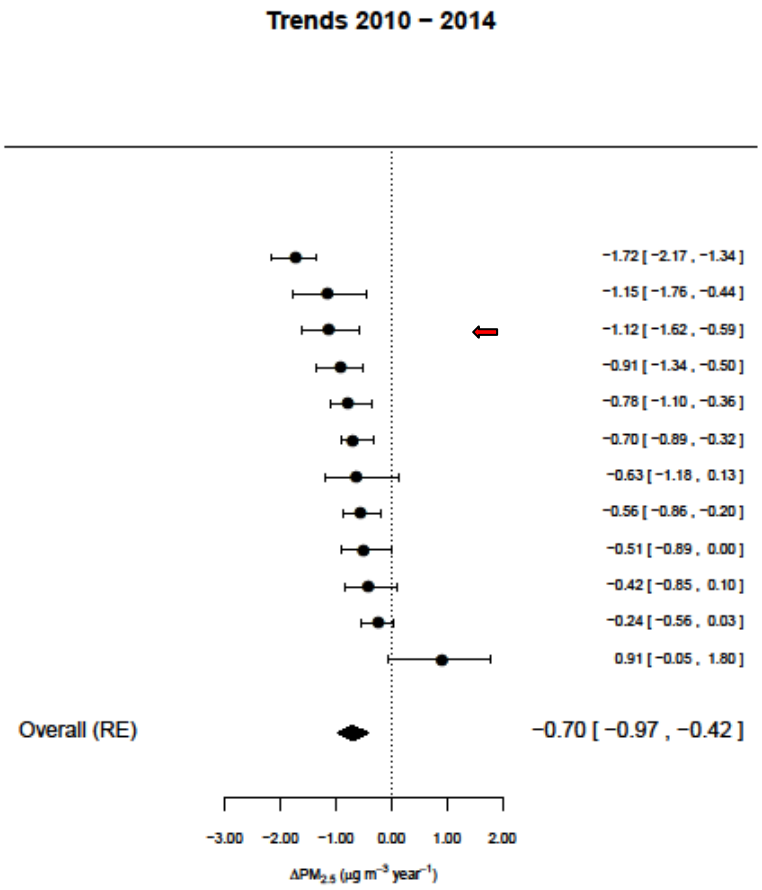


PM_{10}

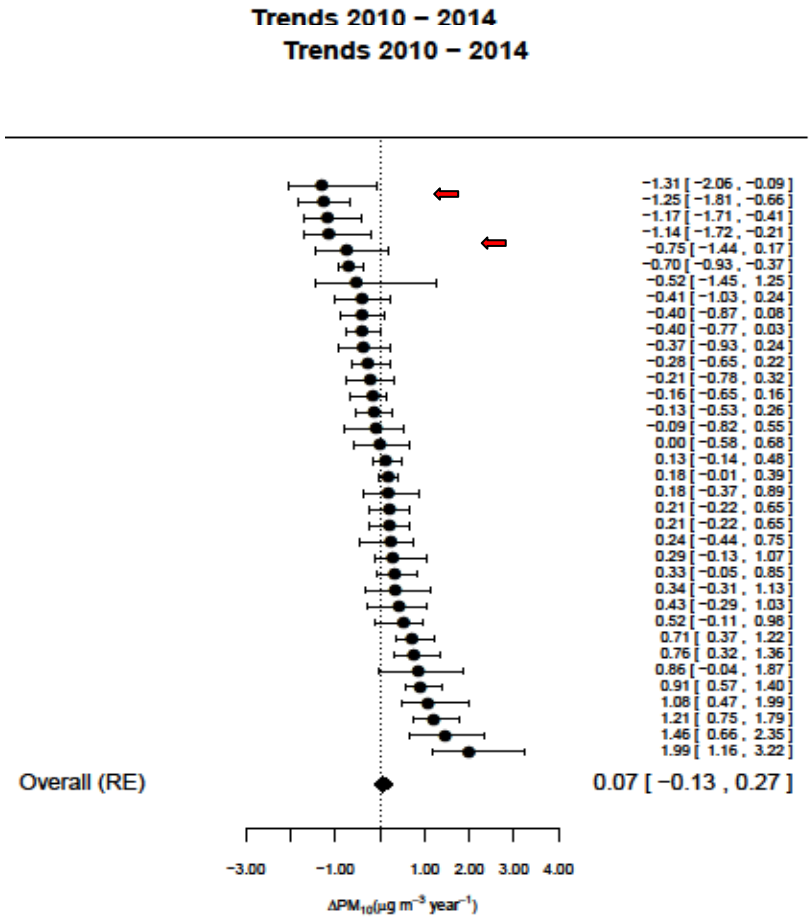

Trends 2005 – 2009
Overall (RE)
−0.19 [−0.34 ,
−3.00
−1.00
0.00
1.00
2.00
3.00
ΔPM10(μg m−3 year−1)


Trends 2010 – 2014
−1.31 [−2.06 , −0.09]
−1.25 [−1.81 , −0.66]
−1.17 [−1.71 , −0.41]
−1.14 [−1.72 , −0.21]
−0.75 [−1.44 , 0.17]
−0.70 [−0.93 , −0.37]
−0.52 [−1.45 , 1.25]
−0.41 [−1.03 , 0.24]
−0.40 [−0.87 , 0.08]
−0.40 [−0.77 , 0.03]
−0.37 [−0.93 , 0.24]
−0.28 [−0.65 , 0.22]
−0.21 [−0.78 , 0.32]
−0.16 [−0.65 , 0.16]
−0.13 [−0.53 , 0.26]
−0.09 [−0.82 , 0.55]
0.00 [−0.58 , 0.68]
0.13 [−0.14 , 0.48]
0.18 [−0.01 , 0.39]
0.18 [−0.37 , 0.89]
0.21 [−0.22 , 0.65]
0.21 [−0.22 , 0.65]
0.24 [−0.44 , 0.75]
0.29 [−0.13 , 1.07]
0.33 [−0.05 , 0.85]
0.34 [−0.31 , 1.13]
0.43 [−0.29 , 1.03]
0.52 [−0.11 , 0.98]
0.71 [0.37 , 1.22]
0.76 [0.32 , 1.36]
0.86 [−0.04 , 1.87]
0.91 [0.57 , 1.40]
1.08 [0.47 , 1.99]
1.21 [0.75 , 1.79]
1.46 [0.66 , 2.35]
1.99 [1.16 , 3.22]
Overall (RE)
0.07 [−0.13 , 0.27]
−3.00
−1.00
1.00
2.00
3.00
4.00
ΔPM10(μg m−3 year−1)

PM_{25}


Trends 2010 – 2014
−1.72 [−2.17 , −1.34]
−1.15 [−1.76 , −0.44]
−1.12 [−1.62 , −0.59]
−0.91 [−1.34 , −0.50]
−0.78 [−1.10 , −0.36]
−0.70 [−0.89 , −0.32]
−0.63 [−1.18 , 0.13]
−0.56 [−0.86 , −0.20]
−0.51 [−0.89 , 0.00]
−0.42 [−0.85 , 0.10]
−0.24 [−0.56 , 0.03]
0.91 [−0.05 , 1.80]
Overall (RE)
−0.70 [−0.97 , −0.42]
−3.00 −2.00 −1.00 0.00 1.00 2.00
ΔPM2.5 (µg m−3 year−1)

PM_{10}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Overall (RE)
0.07 [−0.13 , 0.27]
−3.00 −1.00 1.00 2.00 3.00 4.00
ΔPM10(µg m−3 year−1)

Conclusions

Changes in air pollution in London over the last ~ 10 years show the successful outcomes of some measures to abate road traffic emissions (mainly from petrol vehicles), reduction of S in road fuel, industrial emissions abatement and the decrease in some long-range transported pollutant emissions.

Large decreases in NO_X, and SO_2 early in C21 but have slowed since.

Still very large breaches of the AQS objective for NO_2 in London. Background NO_2 has decreased and there is some indication of slight decrease in road NO_2 since 2010 but the picture is complex and not the same at all locations.

Analysis of differences in trends at specific roads may lead to understanding what changes are actually producing reductions in the real world.

Conclusions

AQS/LV compliance for PM10 is getting better but trend is still up at some sites and non exhaust particulate may be getting worse.

PM_{10} decreases in the last ten years due to drop in regional background.

Trends in $PM_{2.5}$ are confounded by the number of monitoring sites and changes in methodologies. The large decreases in SO_2 concentrations have not resulted in equally dramatic decreases in sulphate PM.

O_3 should not be ignored as concentrations in London rise towards regional background and the regional background itself is slowly increasing (AQEG, 2009).

Thanks

- This presentation has involved the crunching of 10s of millions of air pollution measurements
- Louise Mittal
- Dr Anna Font & Dr Gary Fuller
- Thank you all the boroughs & districts, GLA, Defra and TfL who support the London Air Quality Network enabling this unique London and beyond perspective.

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