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Atmospheric  
Concentrations of PCBs  
and PBDEs on a  
Rural:Urban:Rural  
Transect

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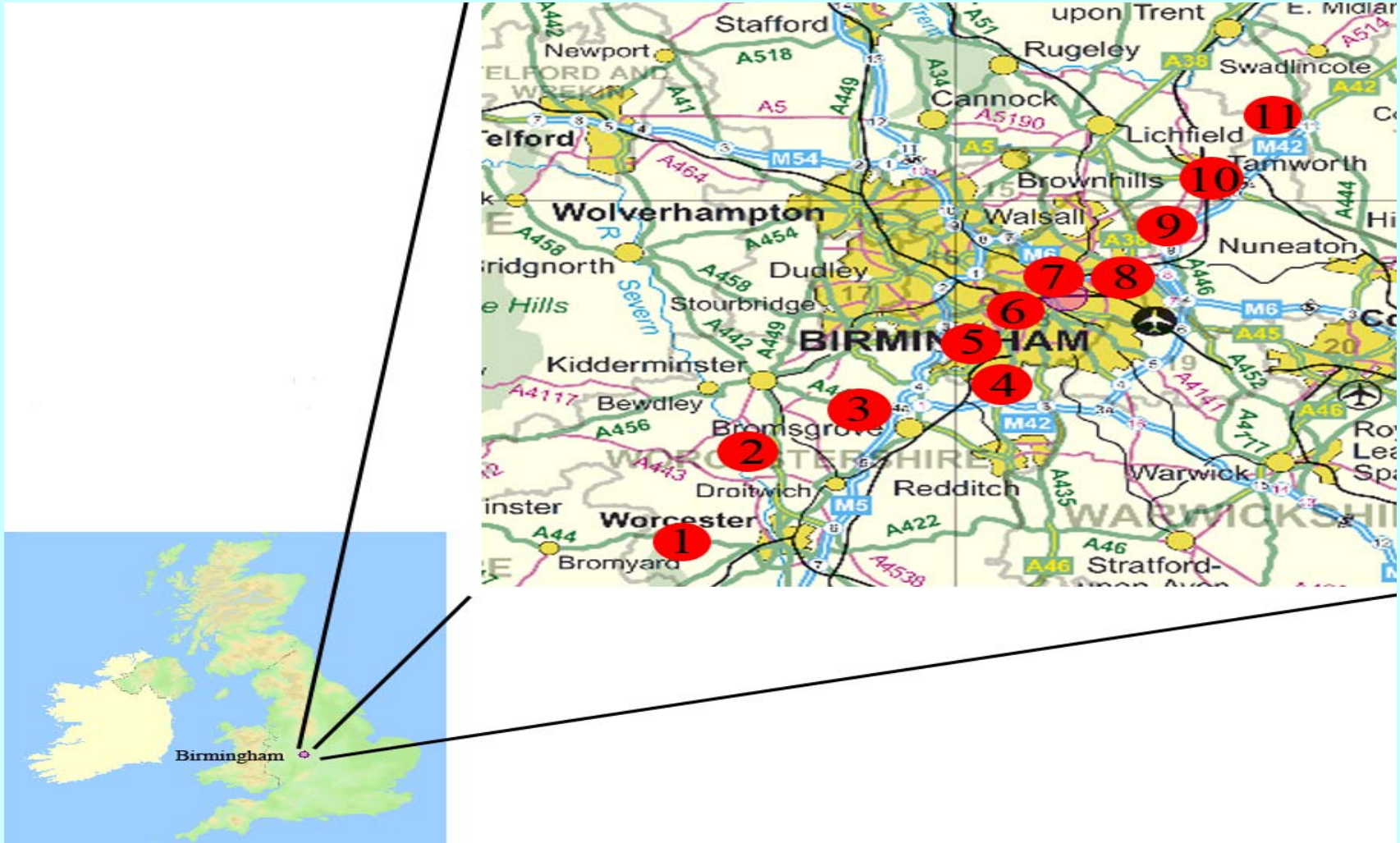
# BACKGROUND (I)

- PBDEs generating increasing interest due to evidence of increasing human body burdens and possible adverse health effects
- Stubborn environmental persistence of PCBs, combined with continuing health concerns, maintain interest nearly 30 years since their *new* use and manufacture ceased
- Majority of population is urban, therefore urgent need to establish the fate of POPs in conurbations
- In particular, concentrations in outdoor urban air yield valuable information for assessment of the significance of cities as a source of POPs to other regions, including agricultural locations with implications for dietary exposure

# BACKGROUND (II)

- This presentation reports data from a study determining PCB and PBDE concentrations in outdoor air (other matrices to be reported later) at 10 locations situated on a south west-to north east rural-urban-rural transect across the West Midlands of the UK (population 2.5 million)
- Samples taken at each site at approximately monthly intervals over a period of 1 year
- Spatial and seasonal differences in PCB and PBDE atmospheric contamination are thus revealed

# SAMPLING LOCATIONS (I)



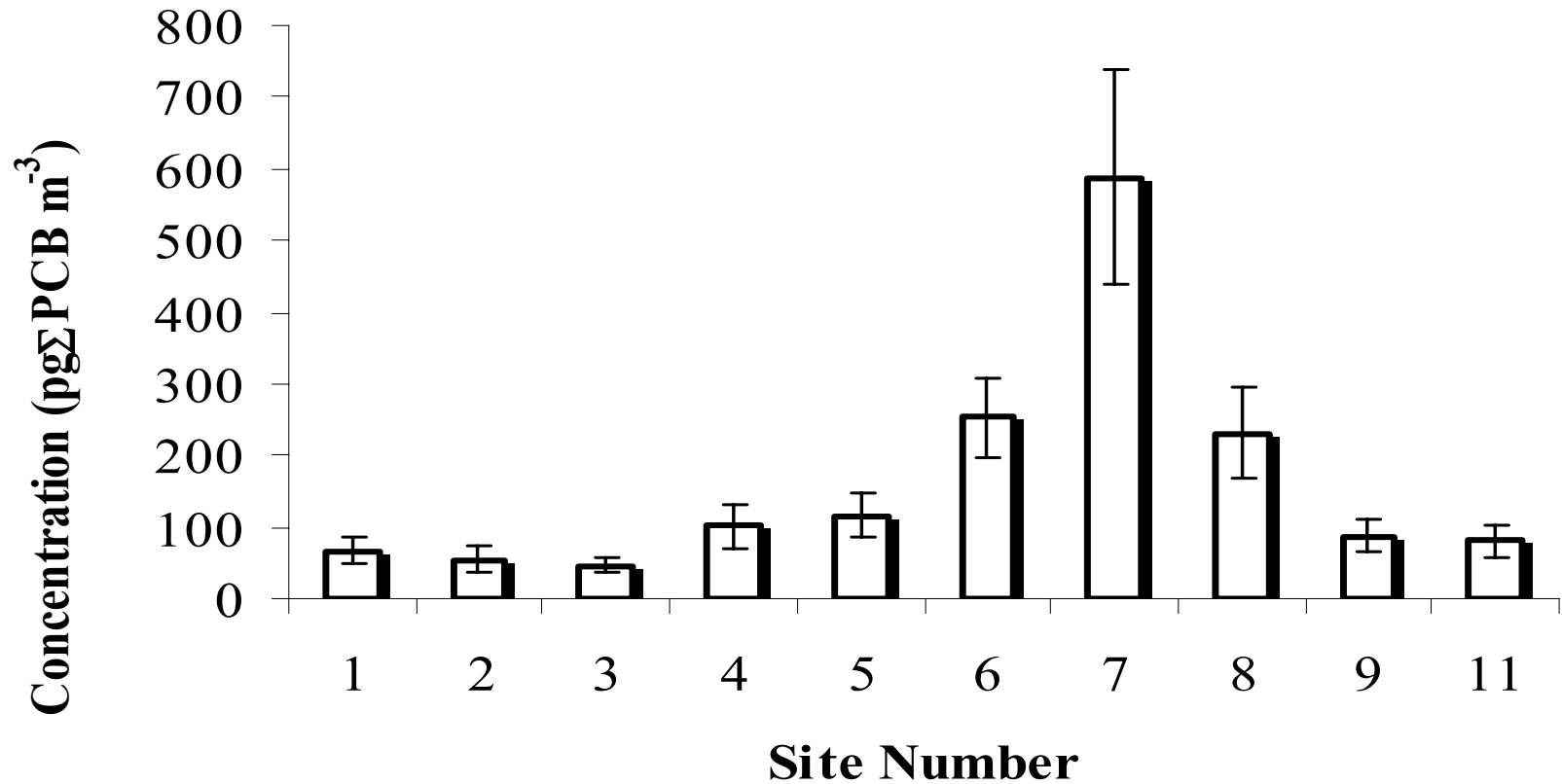
# SAMPLING LOCATIONS (II)

Site Number	Distance from City Centre (km)	Site Classification	Site Name
1	48	Rural	Whitbourne
2	31	Rural	Bishops Wood
3	21	Rural	Chaddesley Wood
4	11	Suburban	West Heath
5	6	Suburban	Weoley Castle
6	3	Urban	EROS
7	0	Urban (City Centre)	Centenary Square
8	6	Urban	Hodge Hill
9	18	Rural	Kingsbury Water Park
10	23	Suburban	Tamworth
11	31	Rural	Newton Regis

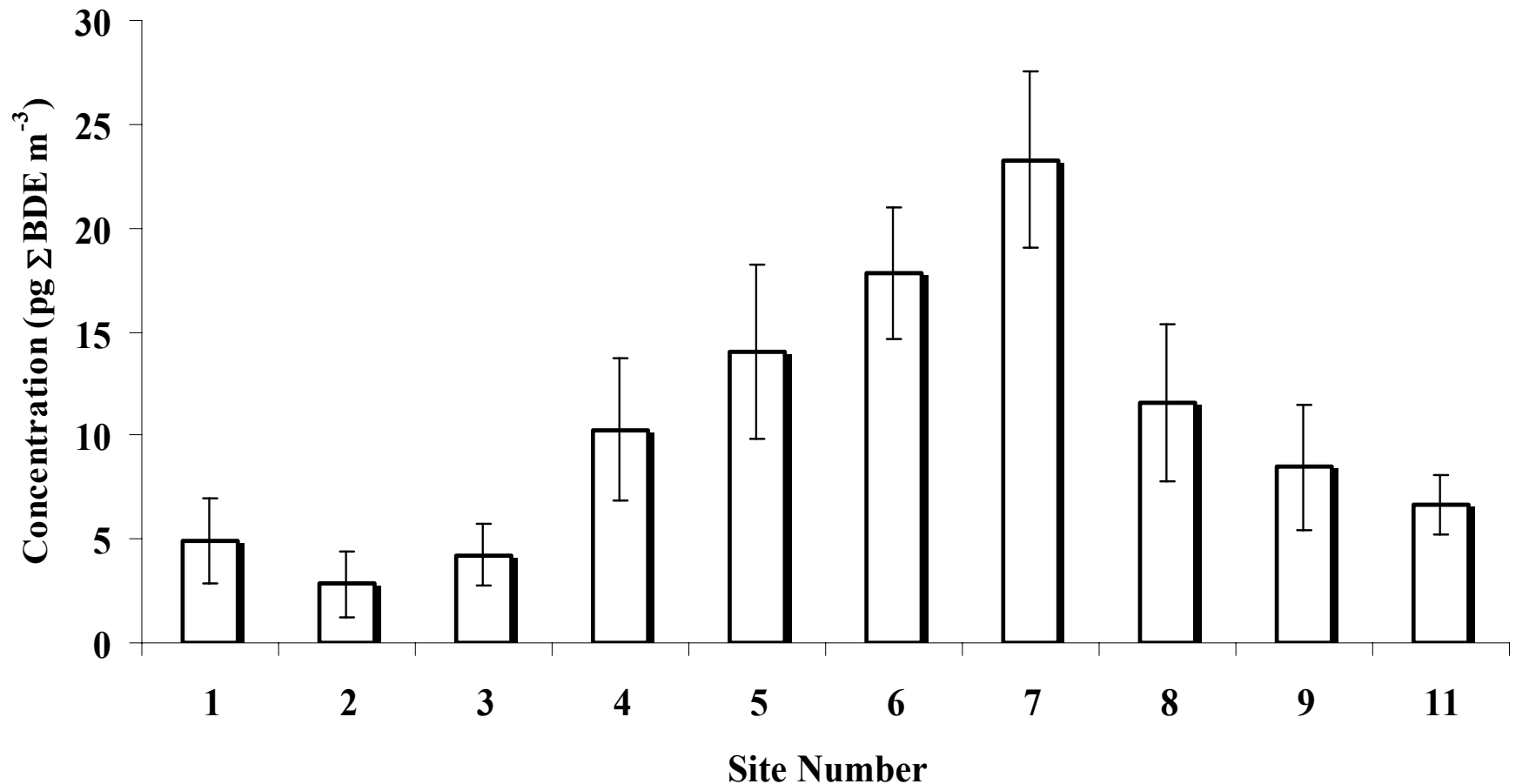
# OVERVIEW OF METHODS

- Outdoor air samples taken at each location using PUF disk passive samplers (4 per site; combined for analysis as one sample) over sampling intervals of 28-55 days (August 2003 - October 2004 = 11 samples at each site)
- Samples treated with internal standards, soxhlet extracted and purified prior to GC/MS analysis using acid washing and Florisil chromatography
- GC/MS conducted on a 60 m HP5 column
- Benchtop MS operated in EI+ SIM mode
- Target PBDEs are 28, 47, 99, 100, 153 & 154
- 78 individual tri- through heptachlorinated PCBs also monitored

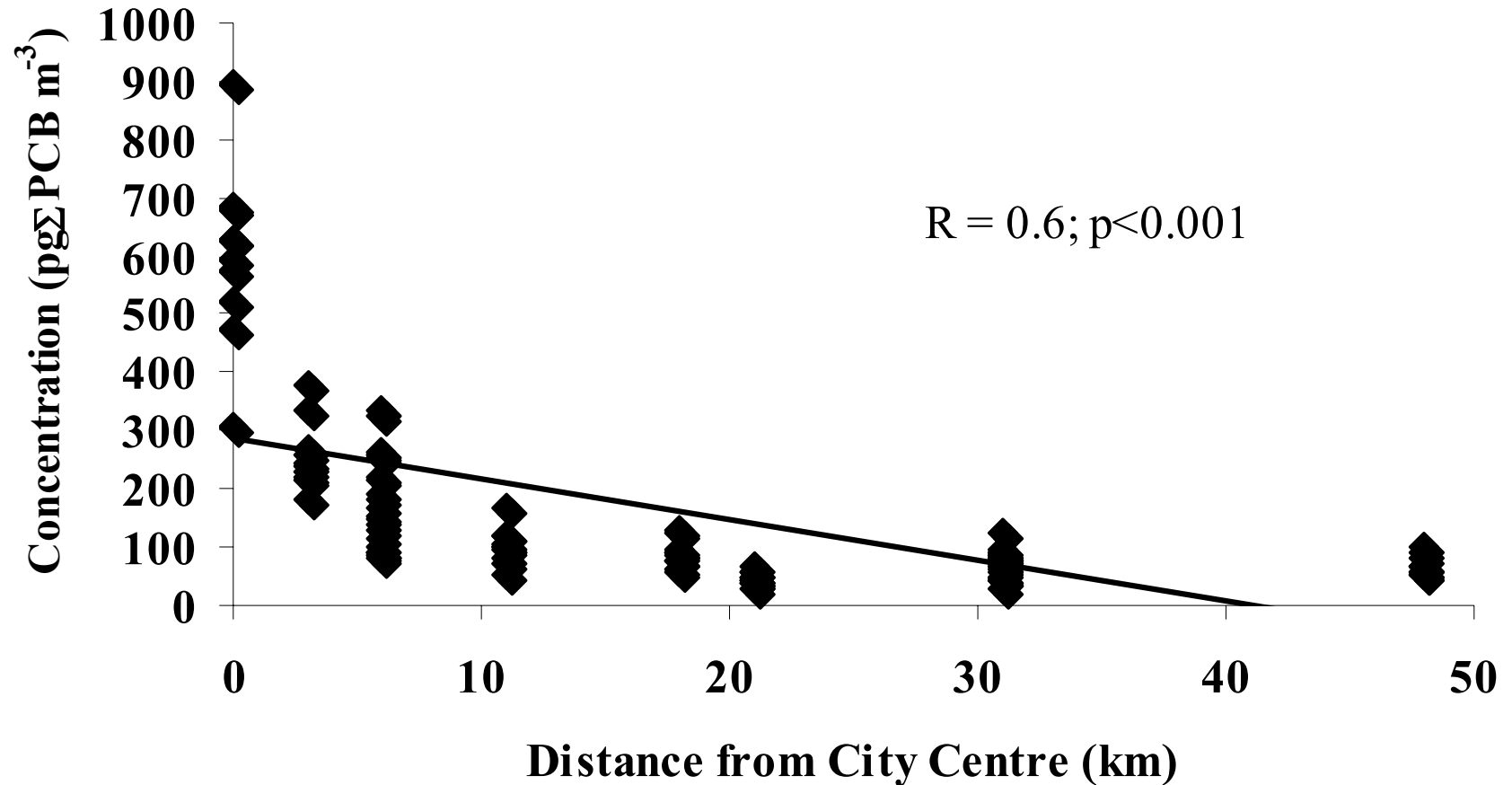
# SPATIAL VARIATION IN $\Sigma$ PCB



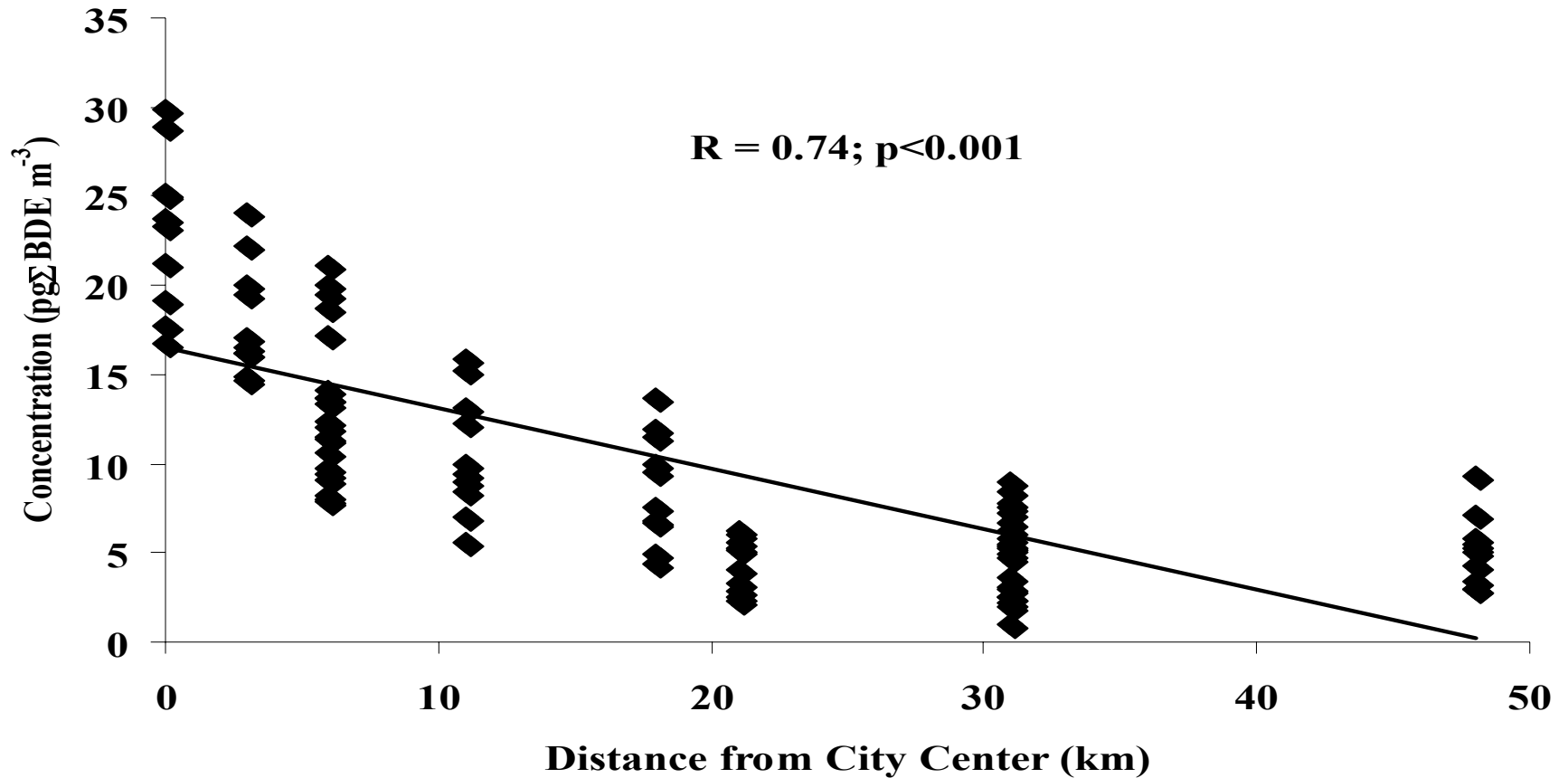
# SPATIAL VARIATION IN $\Sigma$ BDE



# $\Sigma$ PCB CONCENTRATIONS VS. DISTANCE OF SAMPLER LOCATION FROM CITY CENTRE



# $\Sigma$ BDE CONCENTRATIONS VS. DISTANCE OF SAMPLER LOCATION FROM CITY CENTRE



# “URBAN PULSE”

- Strength of “urban pulse” calculated as average concentration at city centre/average at all sites
- Stronger for  $\Sigma$ PCB (3.62) than  $\Sigma$ BDE (2.25)
- Attributable to higher indoor:outdoor (I:O) air concentration gradient for PCBs?
- For  $\Sigma$ PCB average I:average O = 32.3 c.f. 25.9 for  $\Sigma$ BDE
- For  $\Sigma$ PCB median I:median O = 15.4 c.f. 4.4 for  $\Sigma$ BDE
- Furthermore, the higher concentrations to the northeast of the city centre (sites 9 & 11) c.f. those to the southwest (sites 1 & 2) are not inconsistent with the city centre acting as a source of both PCBs and PBDEs to upwind locations

# SEASONAL VARIATION

- As expected, for  $\Sigma$ PCB concentrations, there is a significant ( $p < 0.05$ ) positive linear correlation with air temperature at 6 out of 10 sites
  - Volatilisation from soil? (comparison of chiral signatures in matched air and soil samples suggests not!)
  - Ventilation of contaminated indoor air
- For  $\Sigma$ BDE concentrations, such a correlation ( $p < 0.05$ ) is only observed at the city centre site 7, that displays highest contamination
- Suggests different sources/source strengths/emission pathways to ambient air...?
- Hypothesise ventilation of indoor air important for PBDEs also, but indoor air less contaminated (so far!) and therefore less easy to detect impact over the ambient background in advected air
- Currently interpreting data on PCB and PBDE concentrations in soils taken from the same locations and at the end of each air sampling period
- This will permit insights into air:soil partitioning and environmental sources/pathways of both compound classes

# CONCLUSION

- Study corroborates findings (“urban pulse”) of a similar recent transect in Toronto
- West Midlands (and by inference cities in general) implicated as a significant source of PCBs and PBDEs to the environment
- Suggested that principal source is ventilation of contaminated indoor air; currently more significant for PCBs, but as more PBDEs are released into indoor environments this could change
- A “double whammy” is implied:
  - Direct exposure via inhalation of indoor air
  - Indirect exposure via ventilation to outdoor air, advection to food growing locations and incorporation into food supply

# ACKNOWLEDGEMENTS

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