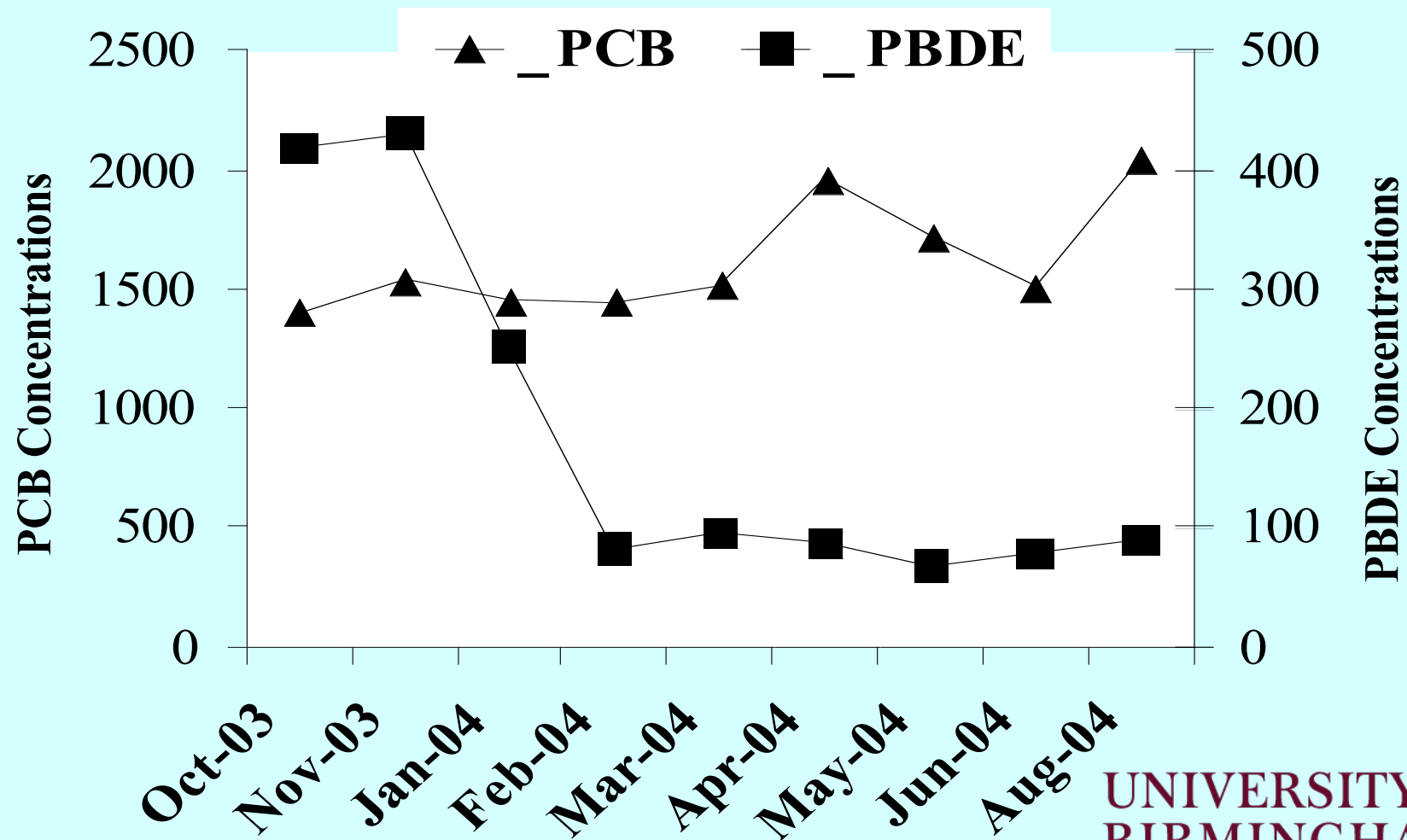


Within-Room Temporal & Spatial Variability in Contamination of Indoor Dust with BFRs: What are the Implications for Exposure Assessment and What Can it Tell us about Sources of Contamination?

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HOW TEMPORAL VARIABILITY IN AIR CONCENTRATIONS REVEALED A PC AS A SOURCE OF PBDEs



QUESTIONS ADDRESSED

- How does within-room spatial and temporal variability in BFR contamination of dust:
 - Influence human exposure via dust ingestion (biological relevance of single “grab” dust samples)
 - Provide insights into sources of contamination

EXPERIMENTAL STRATEGY

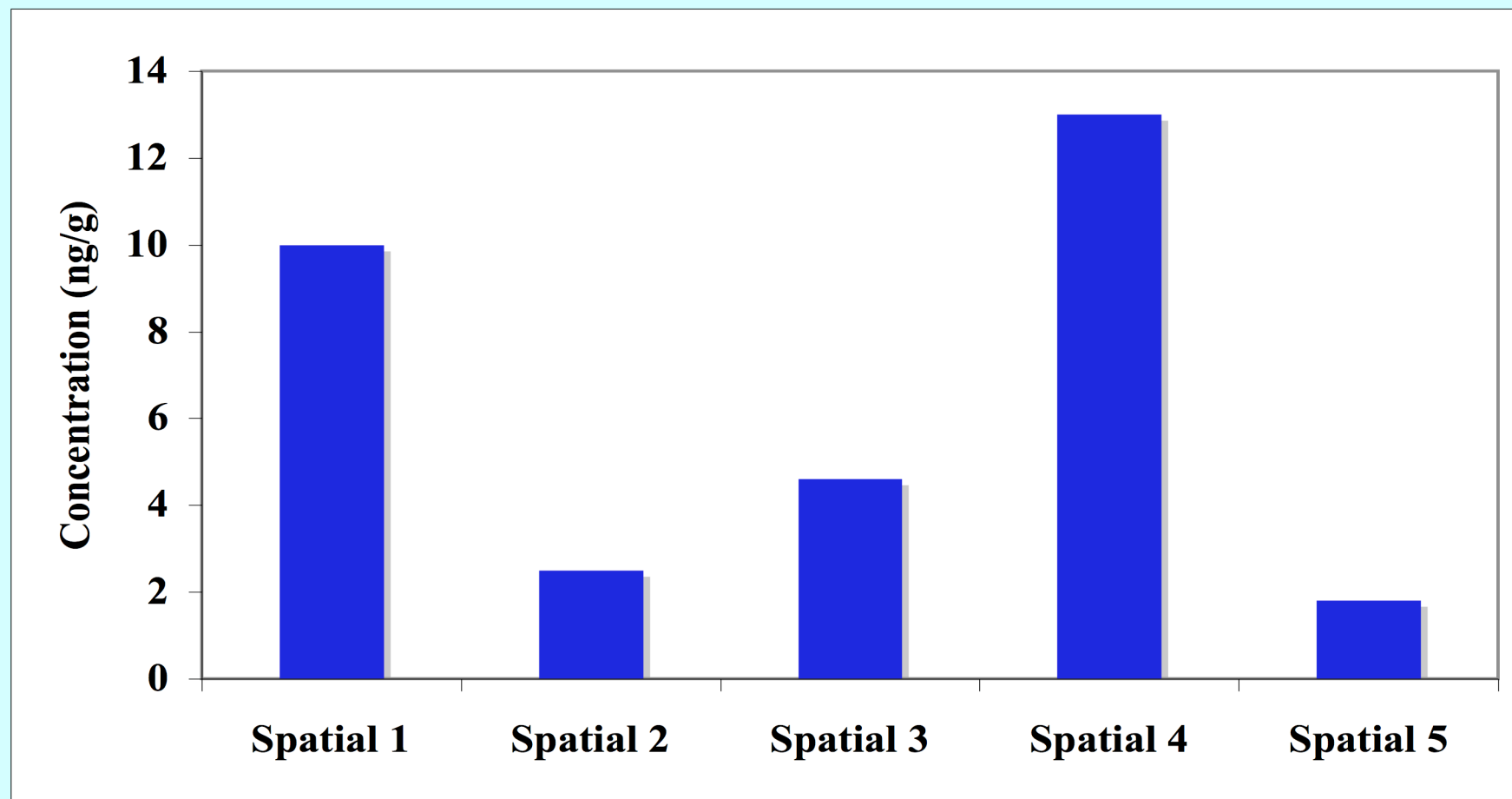
- Spatial variability studied by:
 - Sampling five separate (non-overlapping) 1 m² areas in same room at same time (5 rooms - 2 for BDE-209)
- Temporal variability examined by:
 - Sampling same 1 m² area in the same room every month for 9-10 months (3 rooms)
- Assessed against:
 - Analytical variability (replicate analyses of SRMs 2584/2585).
 - Combined variability due to sample processing (homogenisation & sieving) & analysis (replicate analyses of a single sample derived from the same 1 m² area). RSDs for both <10%

Harrad et al, Environ Int 34, 1170-1175 (2008)

Harrad et al, Environ Int 35, 573-579 (2009)

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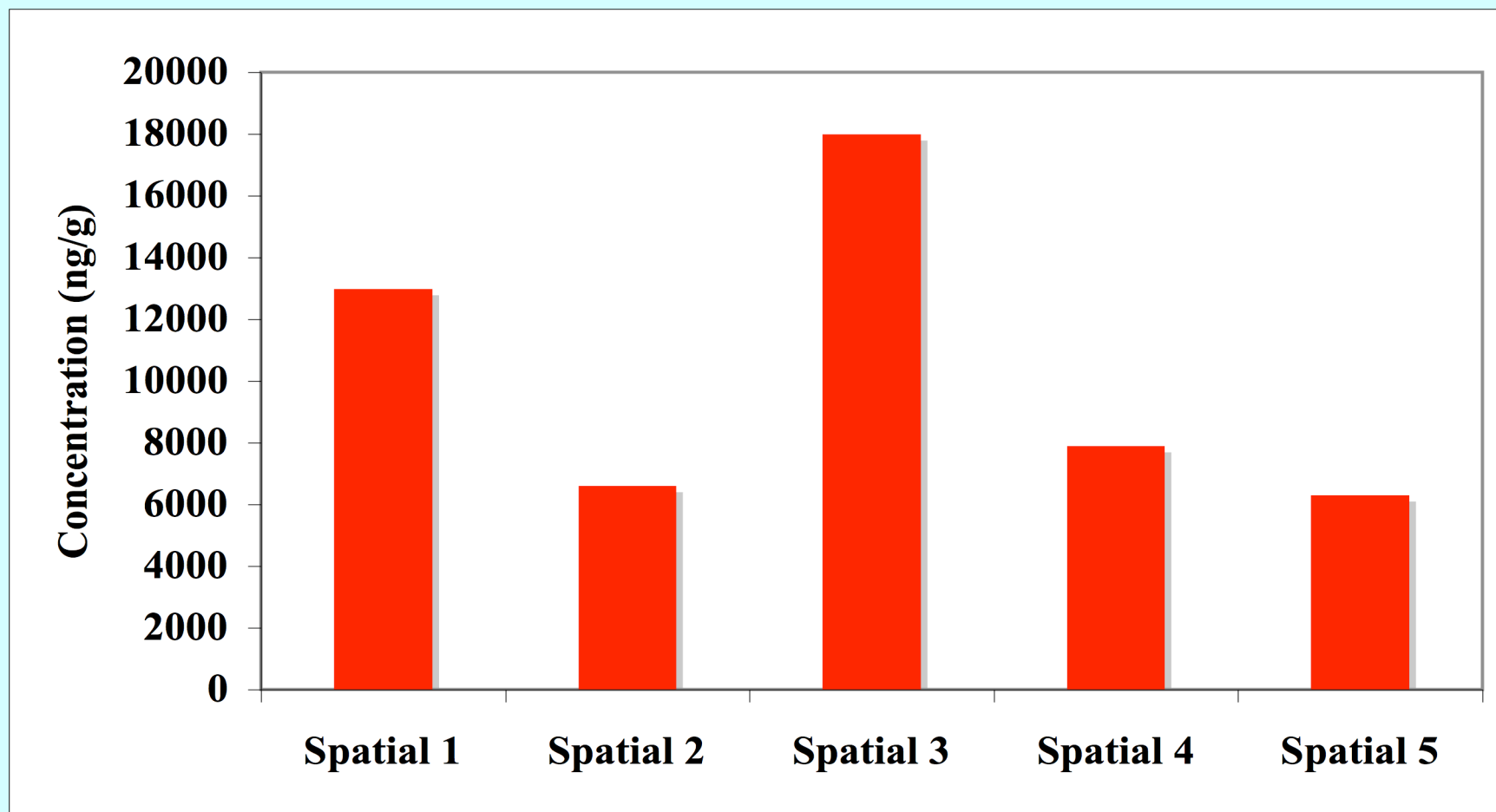
SPATIAL VARIABILITY IN BDE-99



RSD= 77%

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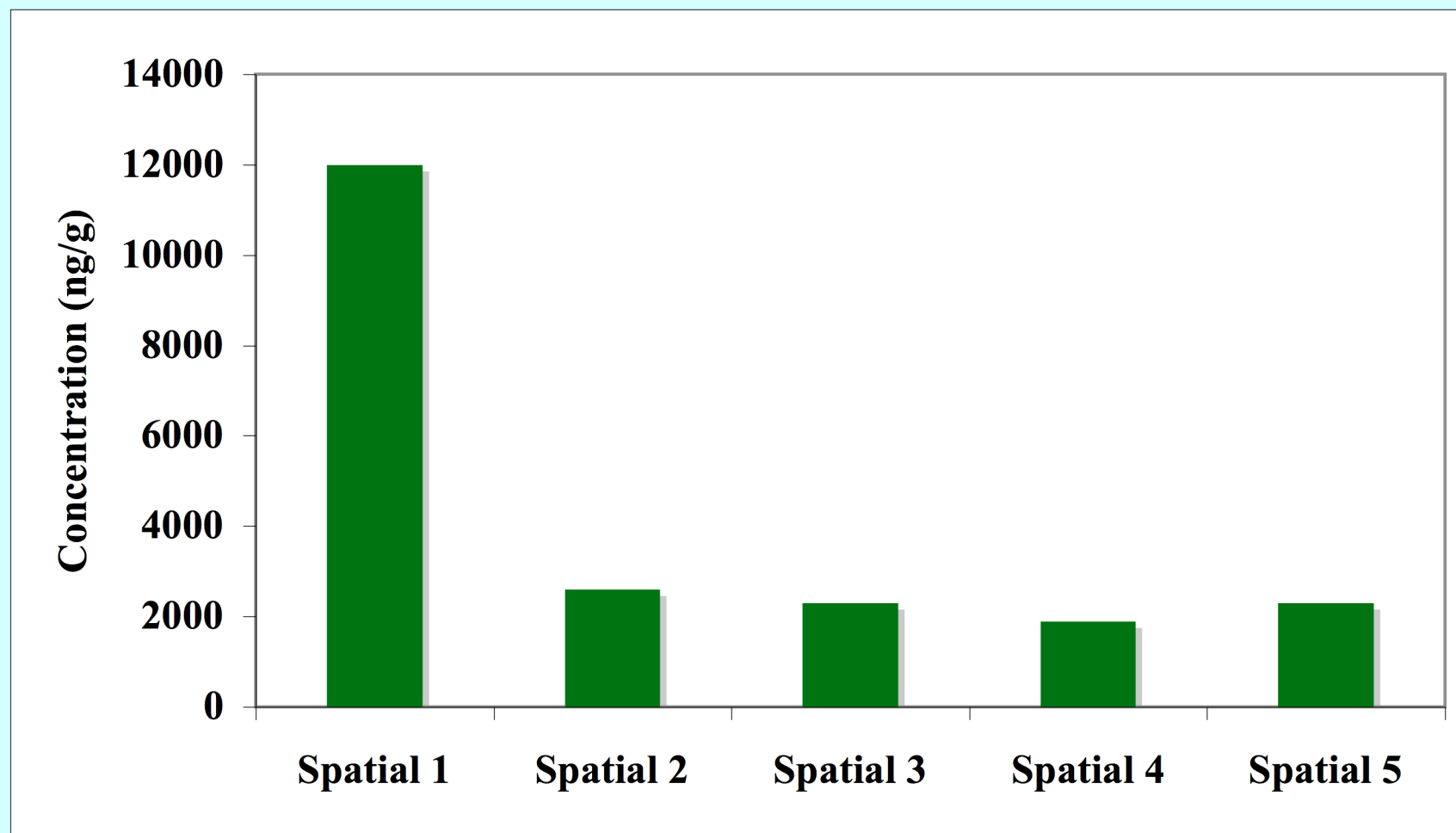
SPATIAL VARIABILITY IN BDE-209



RSD= 49%

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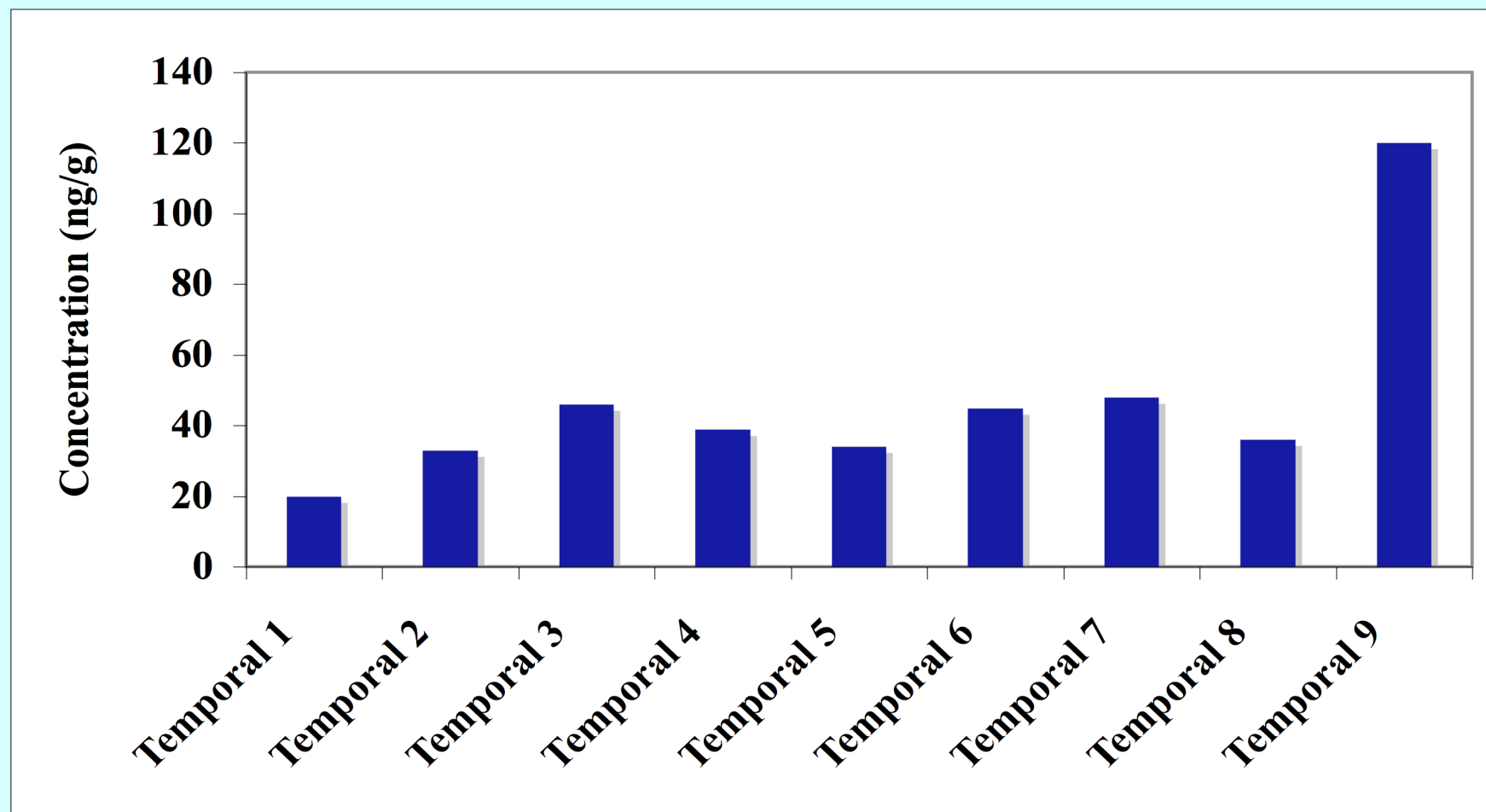
SPATIAL VARIABILITY IN Σ HBCDs



RSD= 100%

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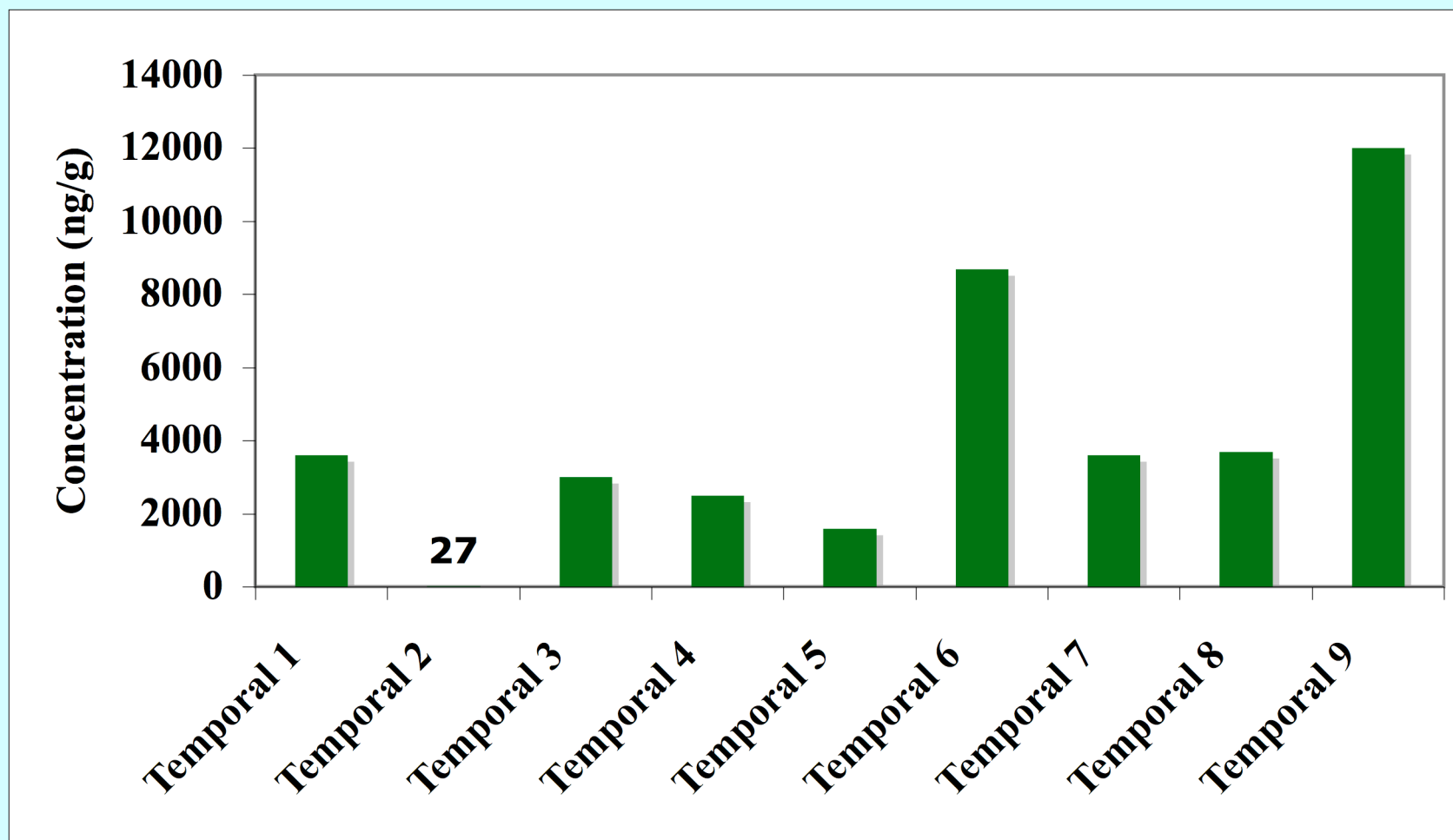
TEMPORAL VARIATION IN BDE-99



RSD= 57%

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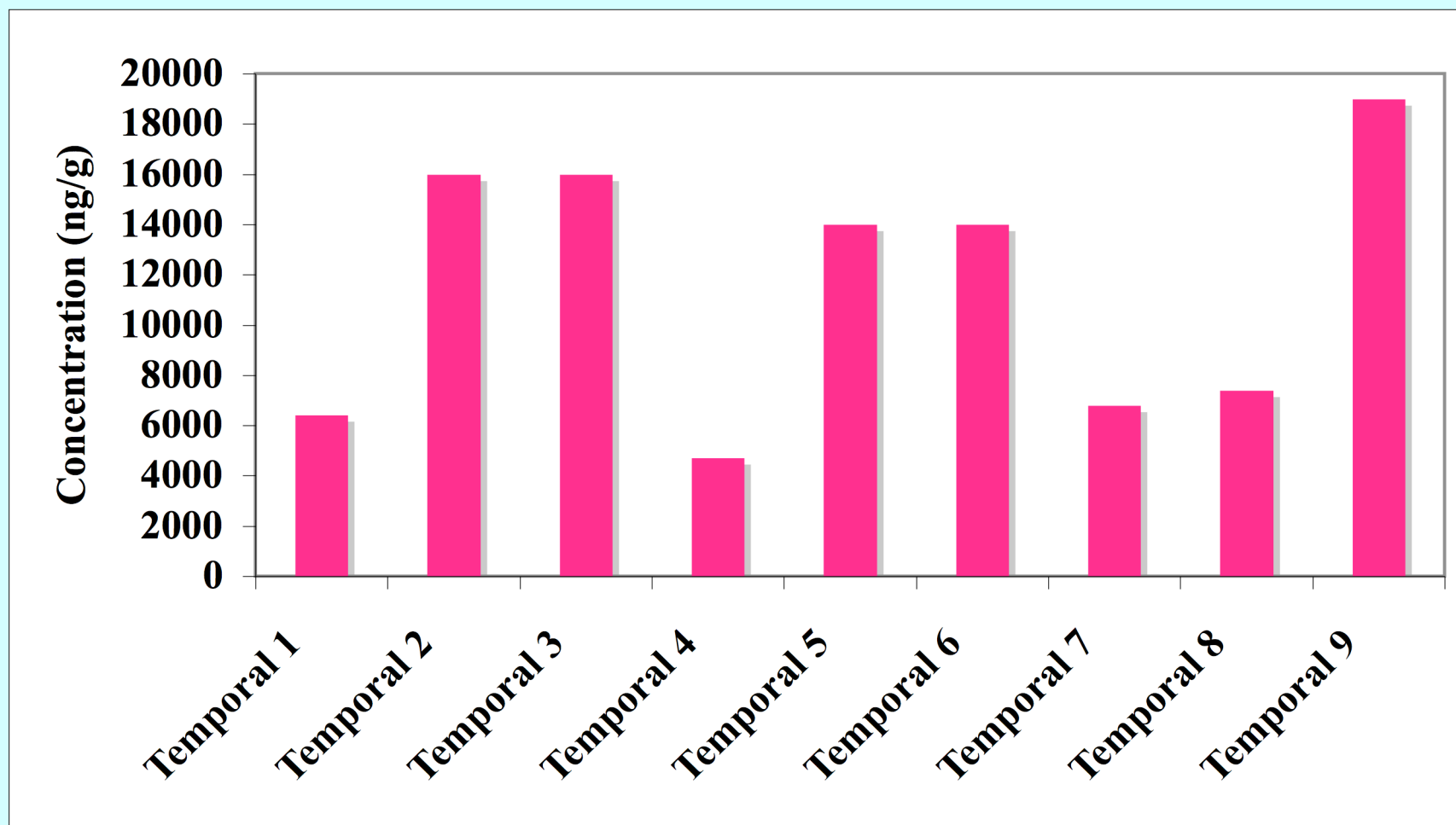
TEMPORAL VARIATION IN BDE-209



RSD= 82%

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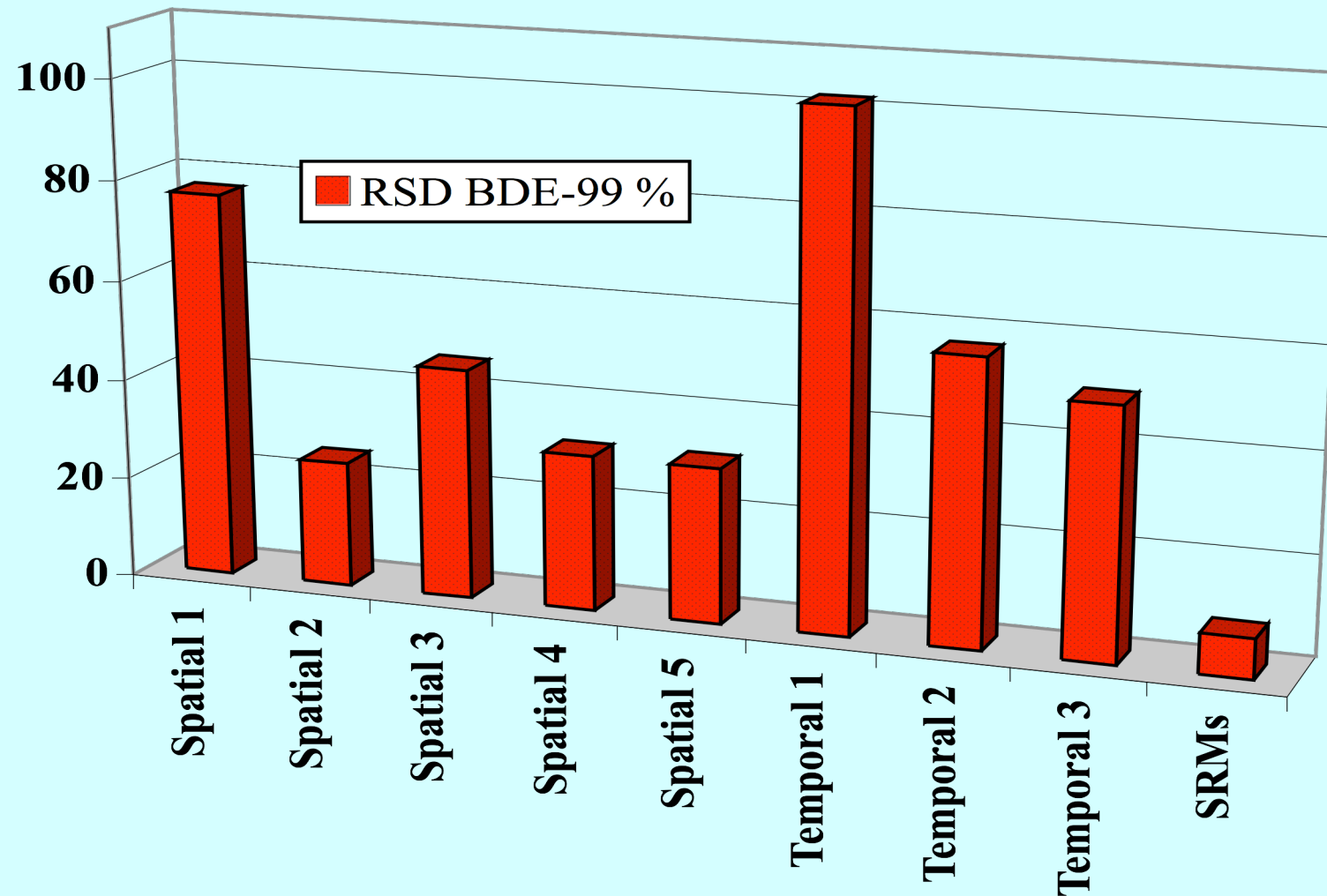
TEMPORAL VARIATION IN Σ HBCDs



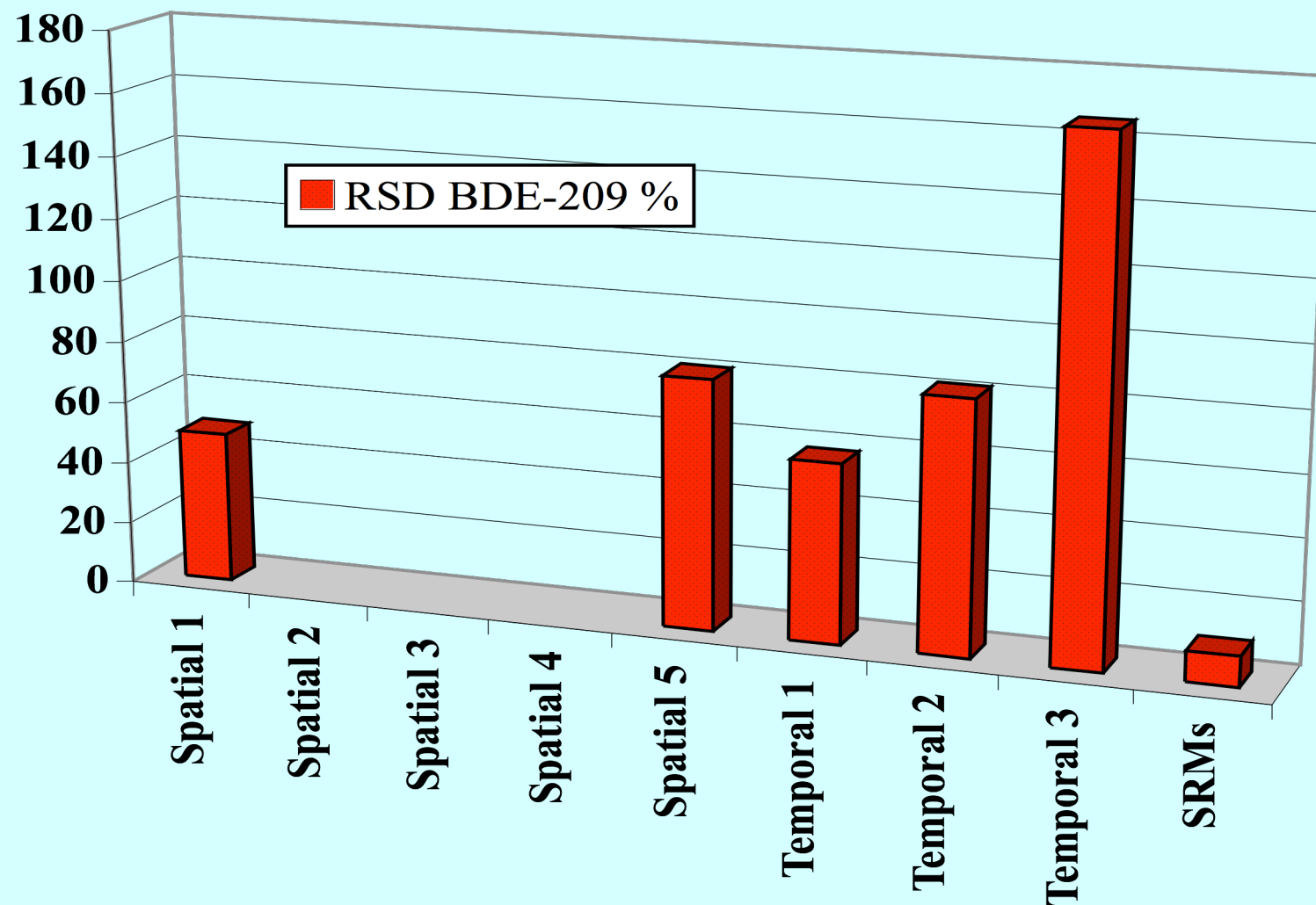
RSD= 42%

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SUMMARY FOR BDE-99

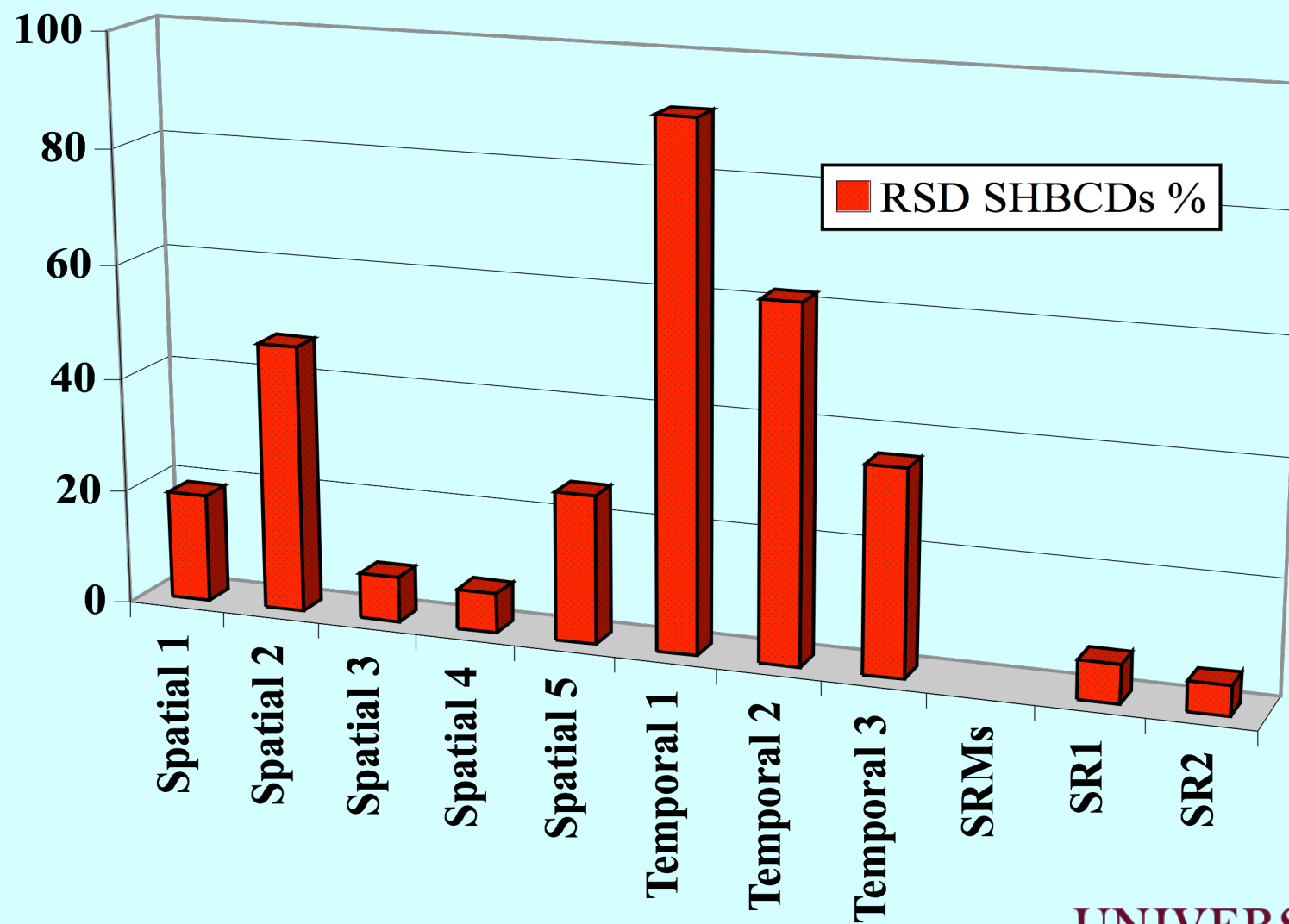


SUMMARY FOR BDE-209



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SUMMARY FOR Σ HBCDs



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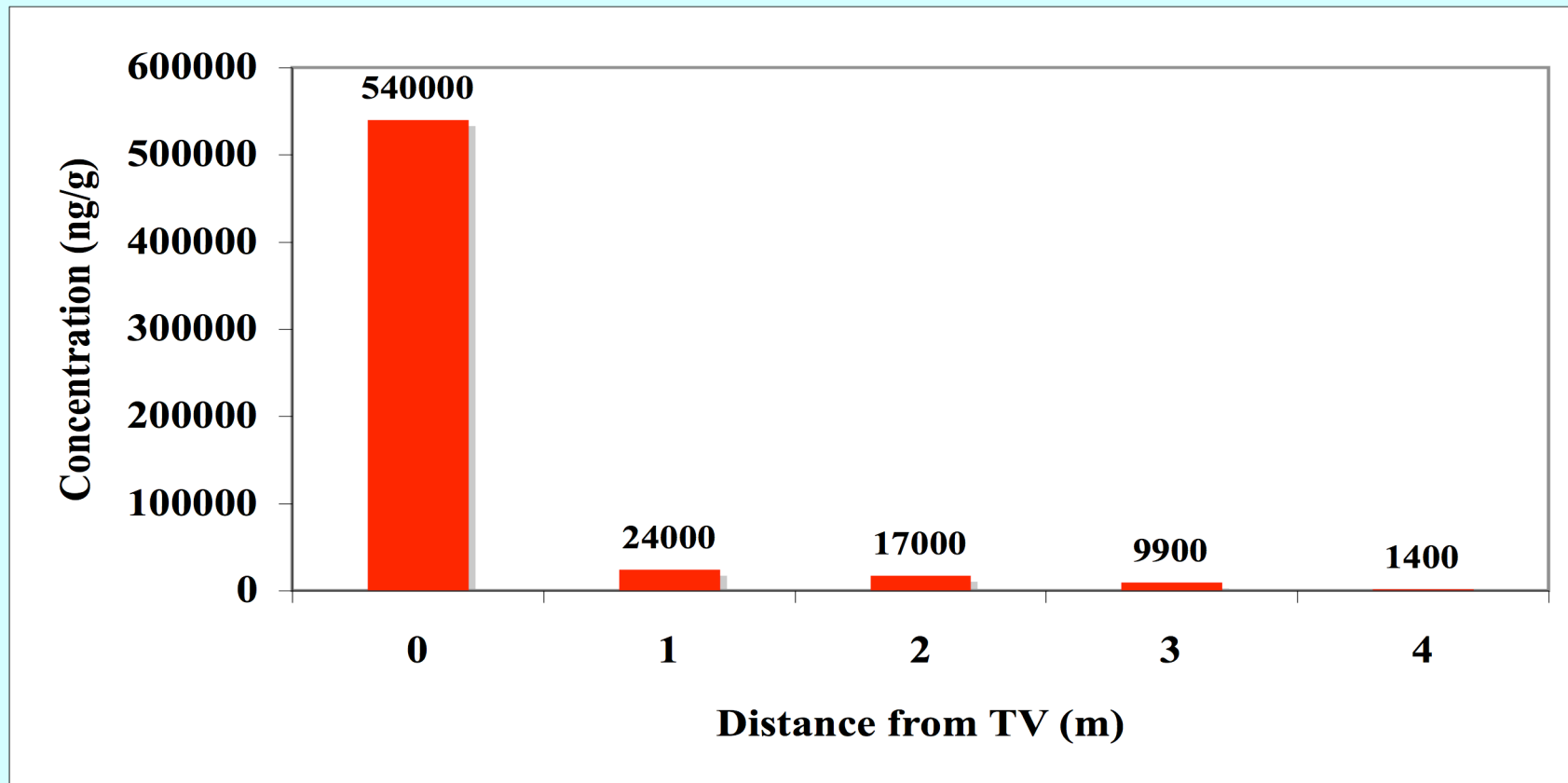
EXPOSURE IMPLICATIONS OF SPATIAL VARIABILITY

- Variations that exceed the variability in sample processing and analysis (i.e. in most rooms) may suggest best approach is to sample entire room surface. However...
- May complicate the procurement of biologically-relevant samples where for example concentrations in more-frequented areas of room are substantially different to those elsewhere in room

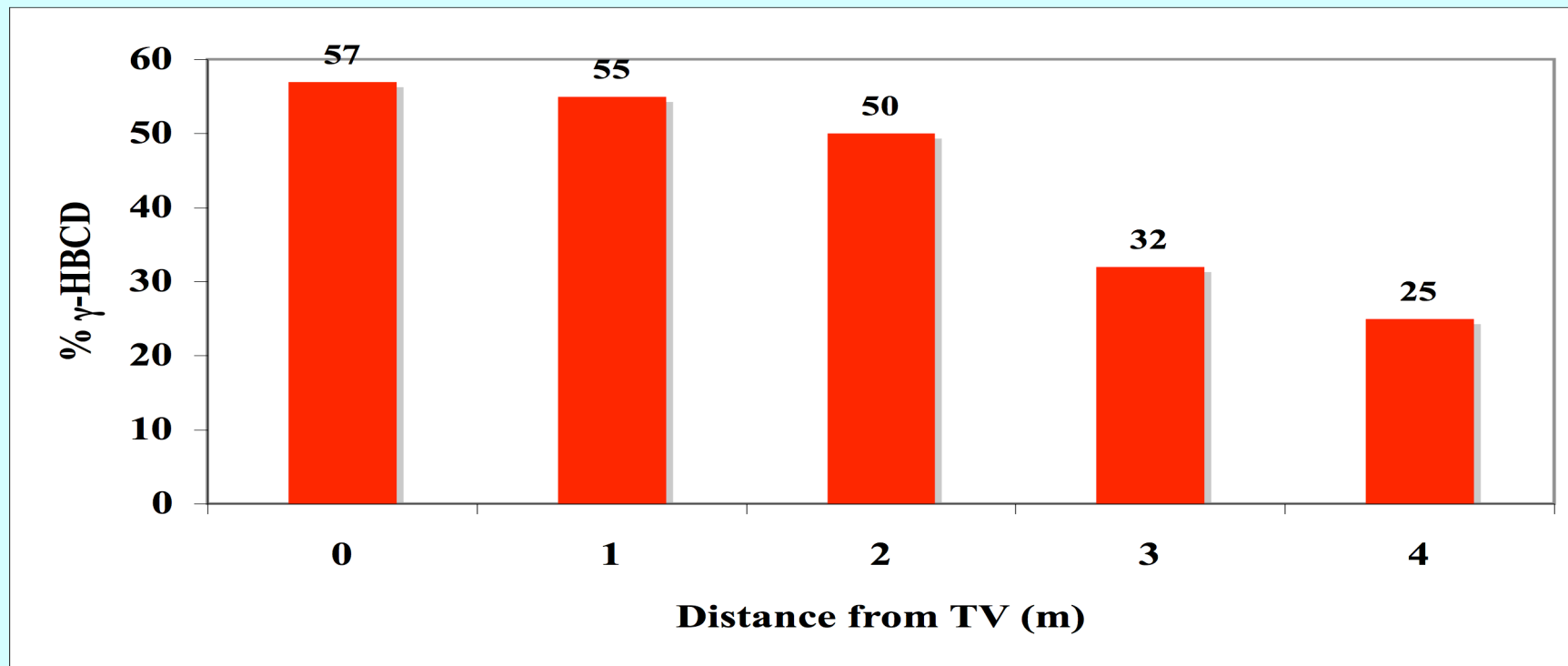
EXPOSURE IMPLICATIONS OF TEMPORAL VARIABILITY

- In many cases, indications are that such variability is not so great as to compromise seriously the biological-relevance of a single “grab” sample at one point in time. However...
- Highest and lowest concentrations of BDE-209 in one room over a 9 month period differ 400-fold
- Contamination within-room influenced by presence/absence and exact location of point source(s)
- For contaminants where human half-life is short (e.g. BDE-209), may be wise to integrate more than one dust sample over a period of time to reflect better human exposure
- Spatial & temporal variations may confound relationships between dust and human contamination

ATTENUATION OF Σ HBCDs IN DUST WITH DISTANCE FROM A TV



ATTENUATION IN % γ -HBCD IN DUST WITH DISTANCE FROM A TV



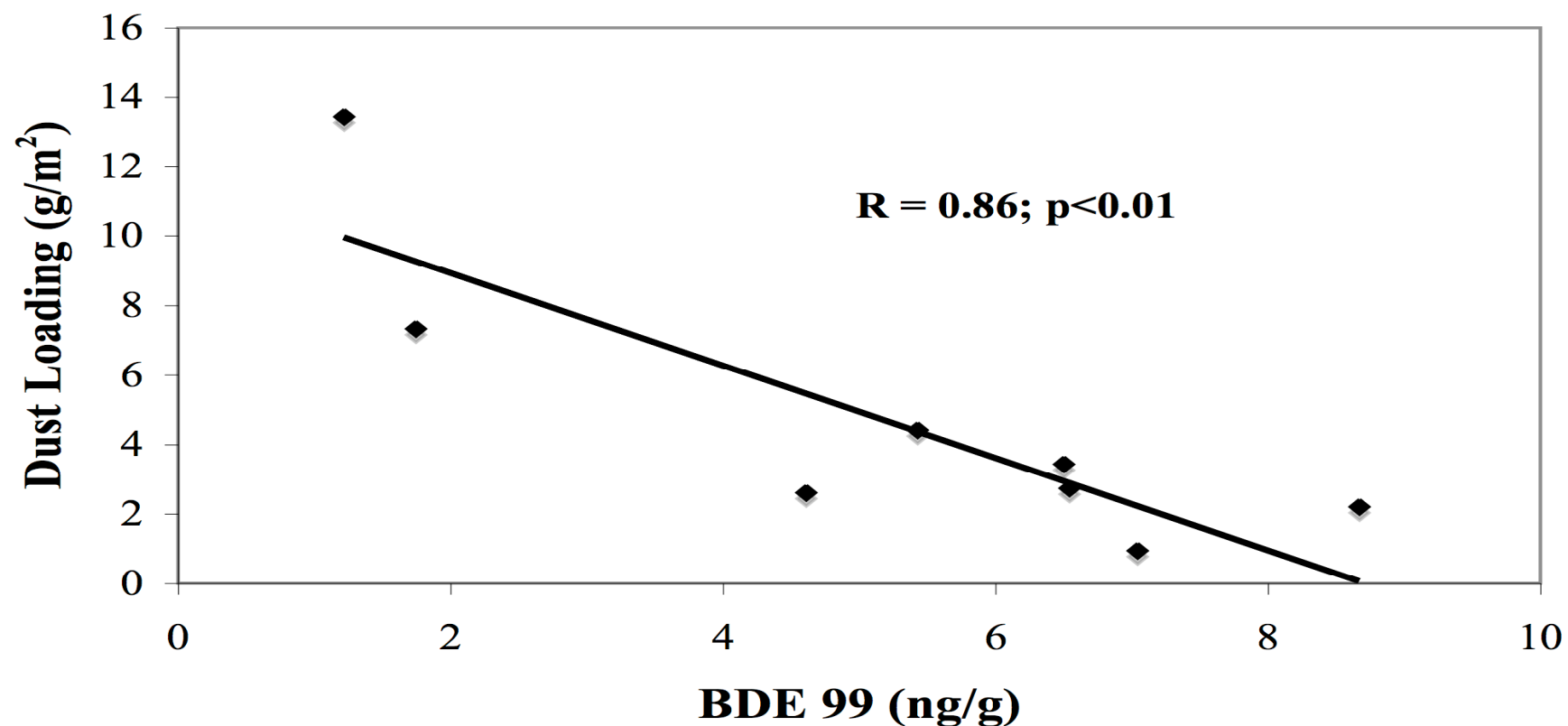
As distance from source (TV) increases; rate of γ -rich fresh inputs is exceeded by rate of photolytically-mediated shift in diastereomer profile to α -HBCD

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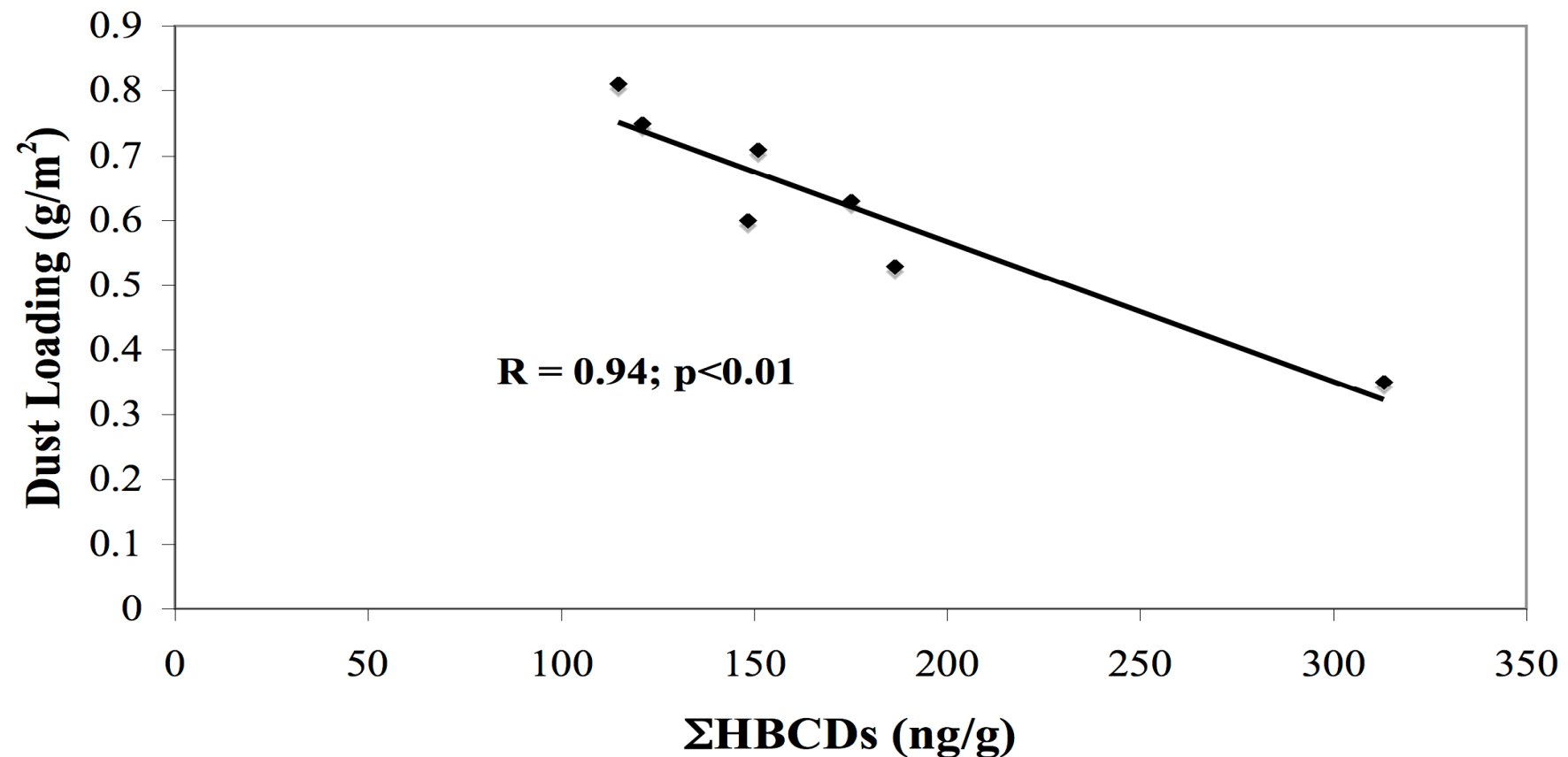
HOW DOES DUST LOADING INFLUENCE EXPOSURE?

- At higher dust loadings (g dust m^{-2} floor), one might anticipate higher dust ingestion hence higher exposure to BFRs. BUT...
- If sources of dust and of BFRs are independent; then at constant BFR emissions, higher dust loadings might “dilute” BFR concentrations in dust
- Studies of temporal variability in two rooms where there was minimal change in room contents (& thus BFR emissions), illustrate this possibility
- In both cases, there is a negative correlation between BFR concentration and dust loading

VARIATION IN CONCENTRATIONS OF BDE-99 IN DUST WITH DUST LOADING



VARIATION IN CONCENTRATIONS OF Σ HBCDs IN DUST WITH DUST LOADING



TAKE HOME MESSAGES

- Within-room spatial and temporal variability in dust contamination has potentially important implications for assessment of human exposure via dust ingestion, and...
- Its study can provide important insights into the specific point sources of such contamination within a microenvironment
- It also raises possible influence of dust loading on BFR contamination of dust and its implications for exposure (bear in mind also that current estimates of dust ingestion are “fixed” and do not take into account variation with dust loading)

ACKNOWLEDGEMENTS

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