

POPs in Cities

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POPs Network Conference

March 29, 2006

ferguson ave and cannon st., hamilton, ontario



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POPs: Source to Effect



Urban

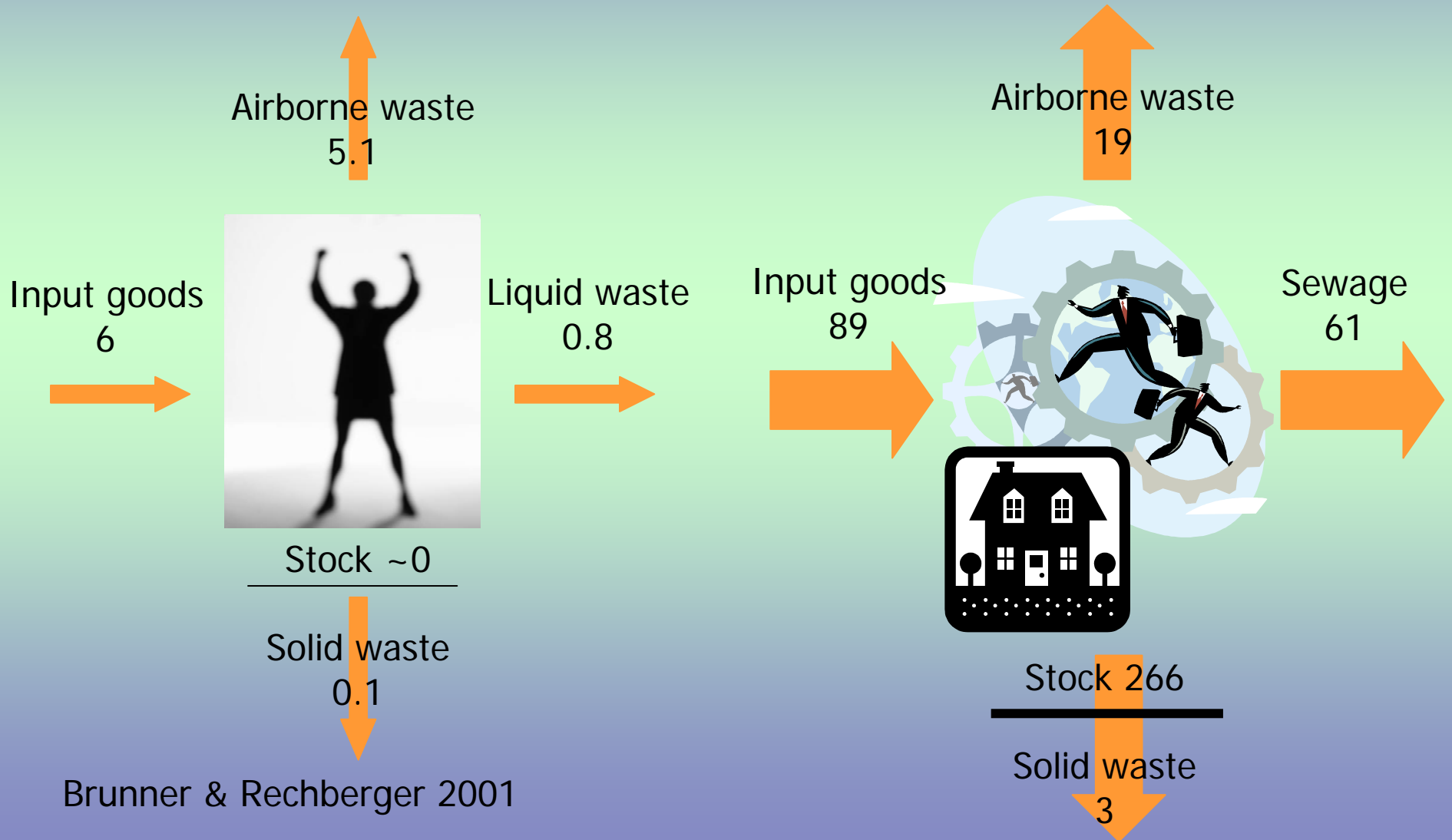
Pathway

Timing

Toxicology
Socio-economic
Status

Per Capita Material Flows

Tons/capita/year



Brunner & Rechberger 2001

Urban Flows & Stocks

Toronto



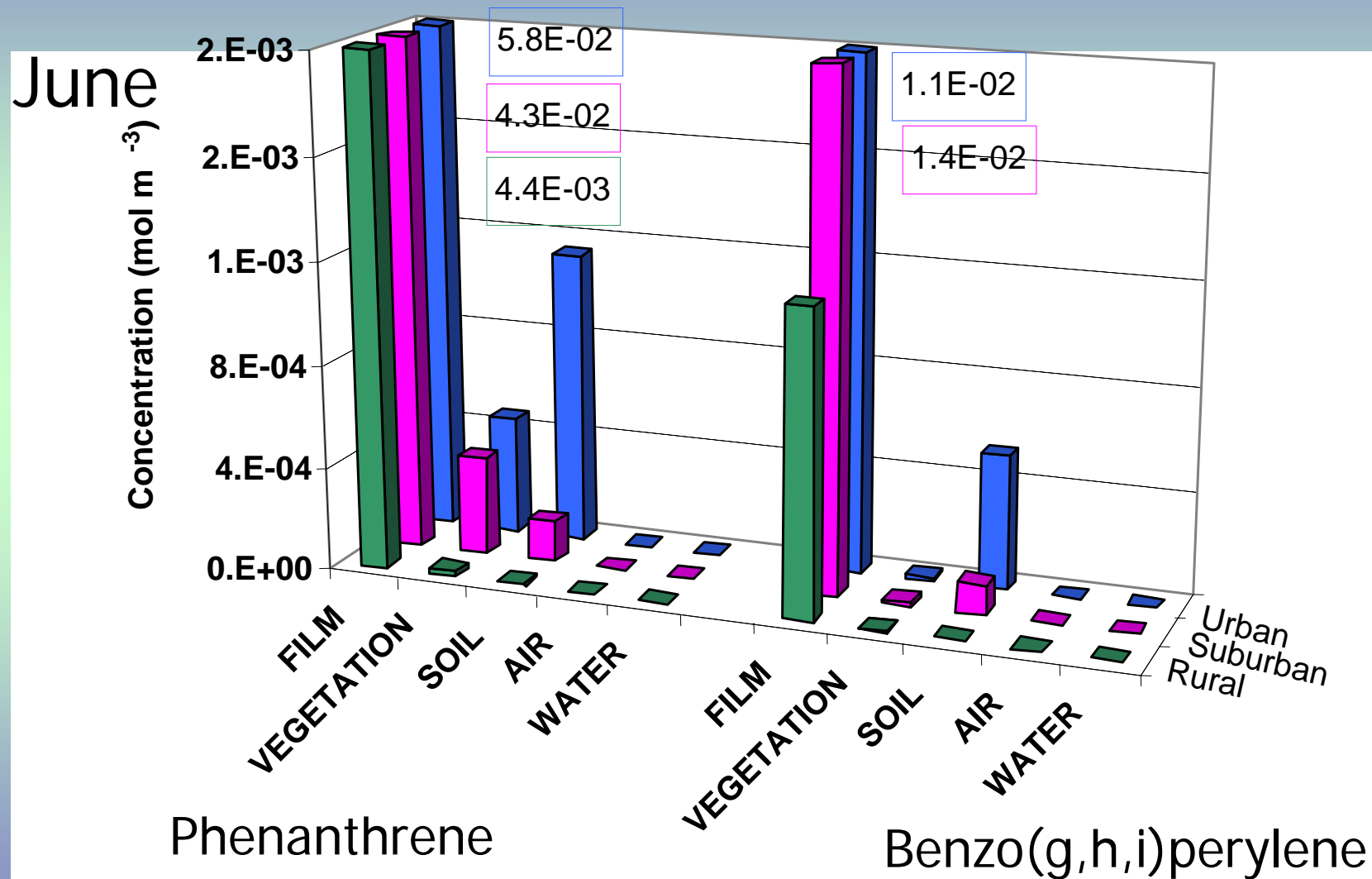
Sahely, Dudding & Kennedy 2003 Can J. Civ. Eng.



mohawk rd and upper wentworth, hamilton, ontario

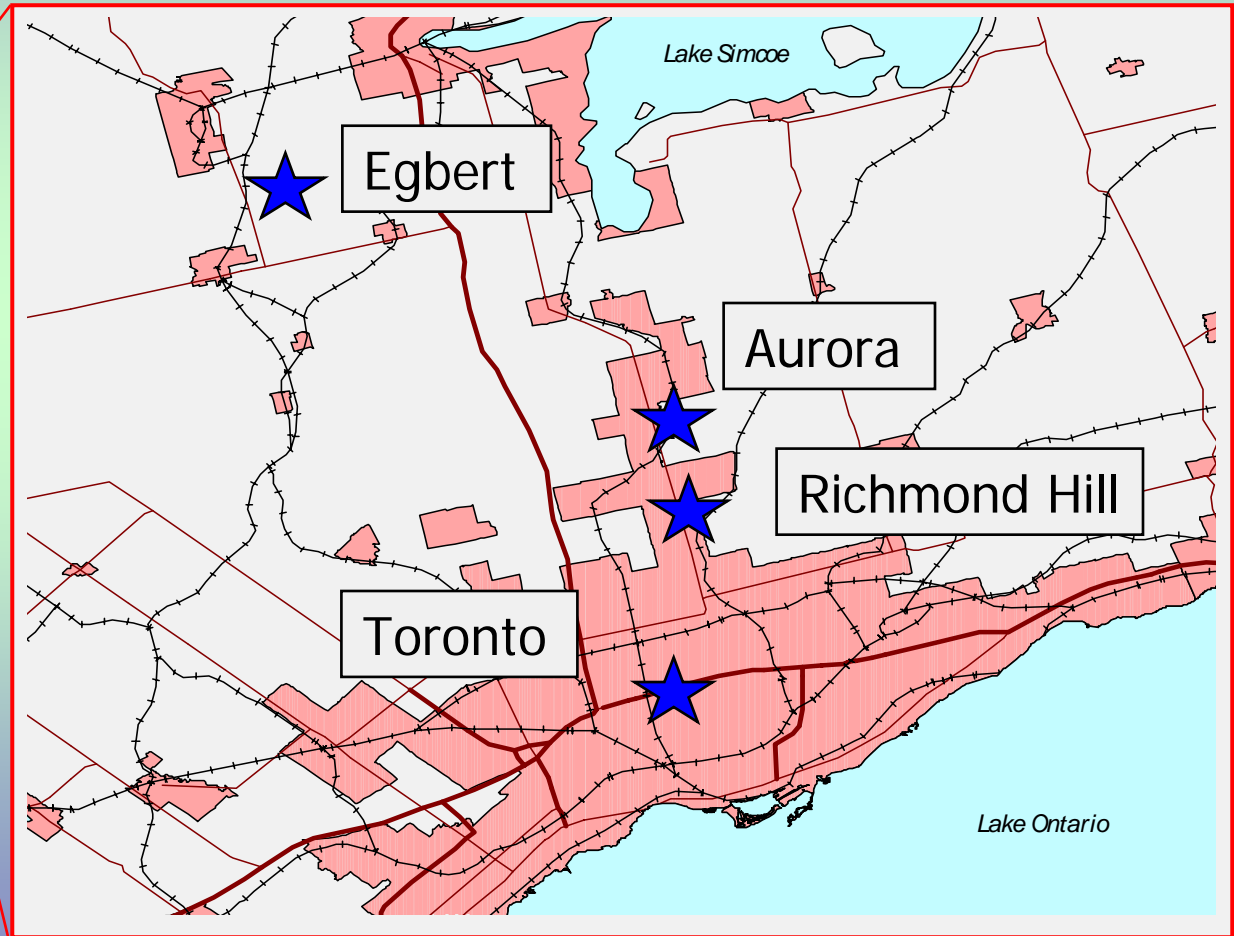


Multimedia Concentrations: Hamilton



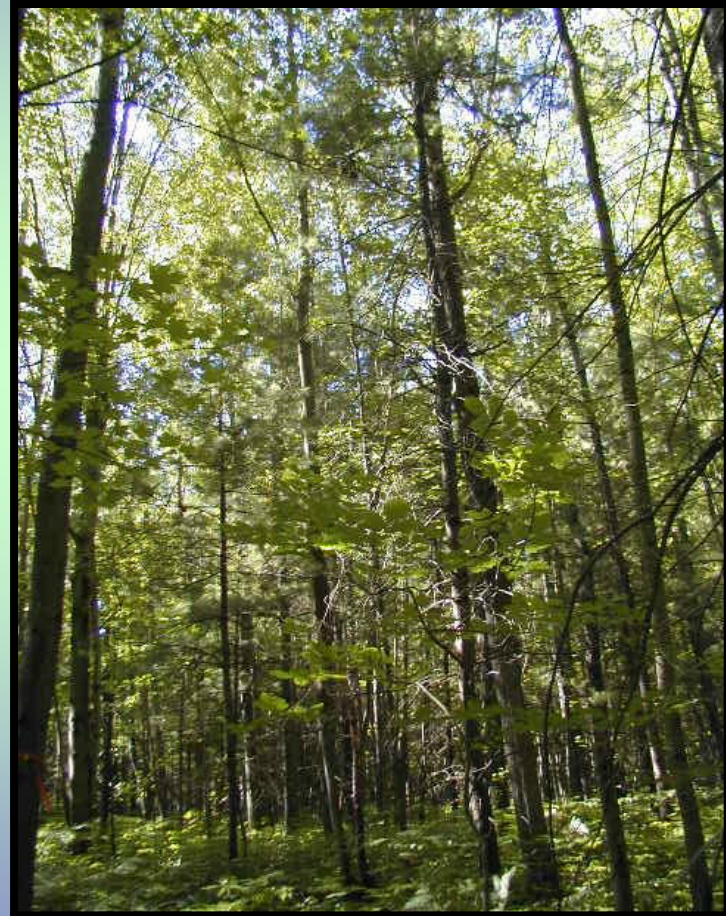
Clarke et al. In prep.

Urban-Rural Gradient



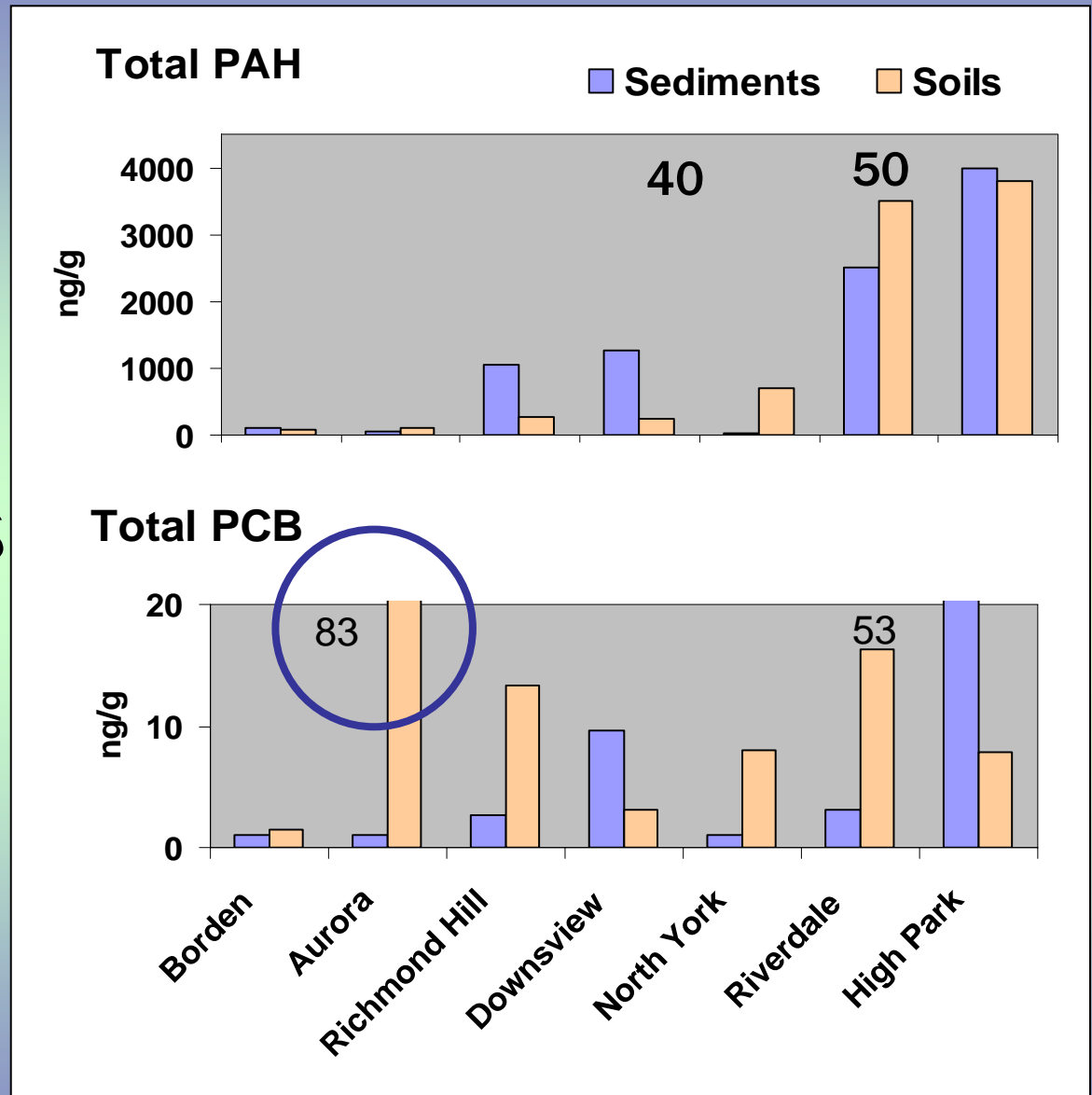
Forest Soils & Pond Sediments

- PCB
- PAH
- OCP



Wong et al. 2004 *Environ. Pollut.* 129:387-398,
Wong et al. 2003 *Organohalogen Comp.* 62:301-304.

Soils & Sediments PAH & PCBs

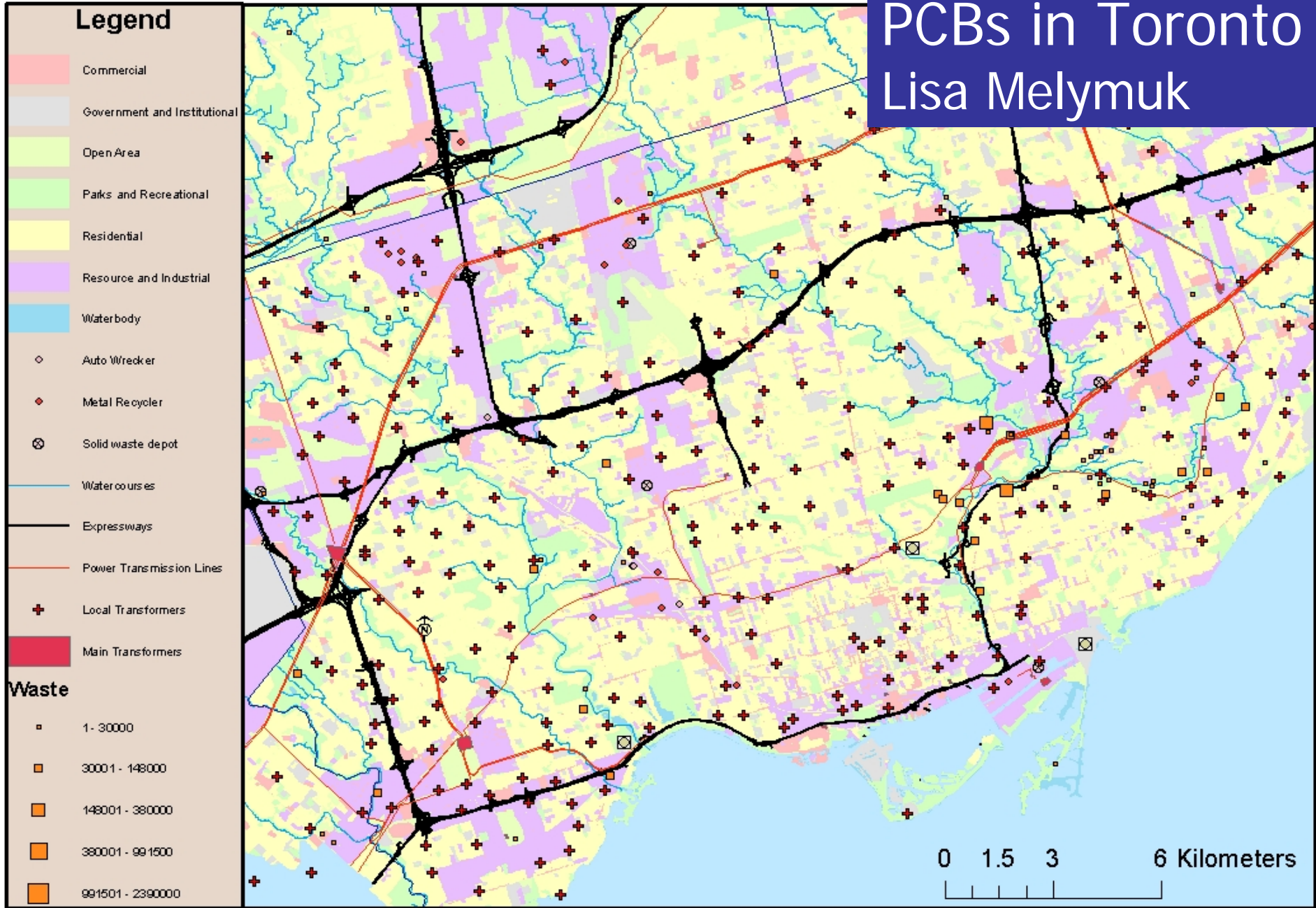


Wong et al. in prep

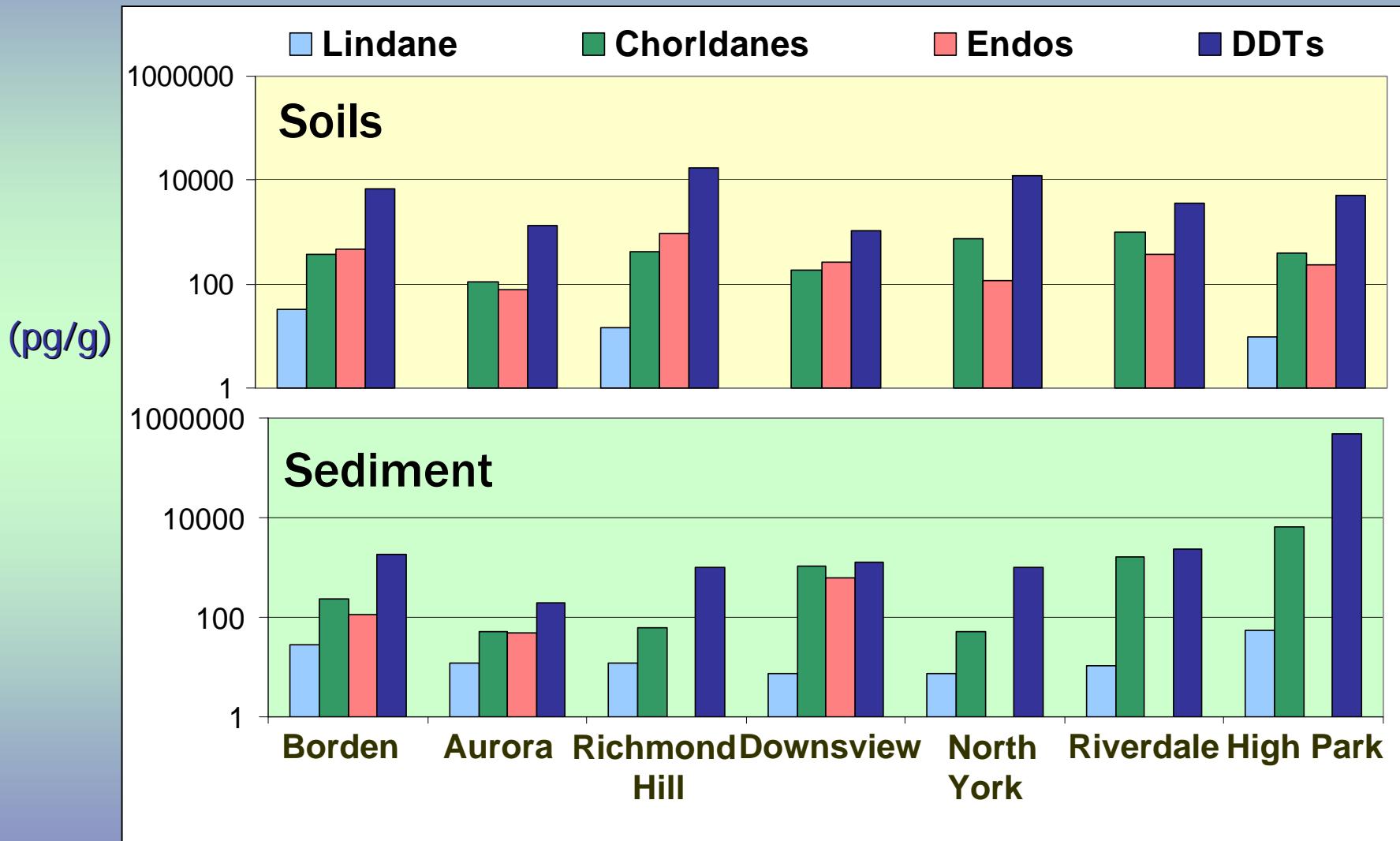
rural → urban

PCBs in Toronto

Lisa Melymuk



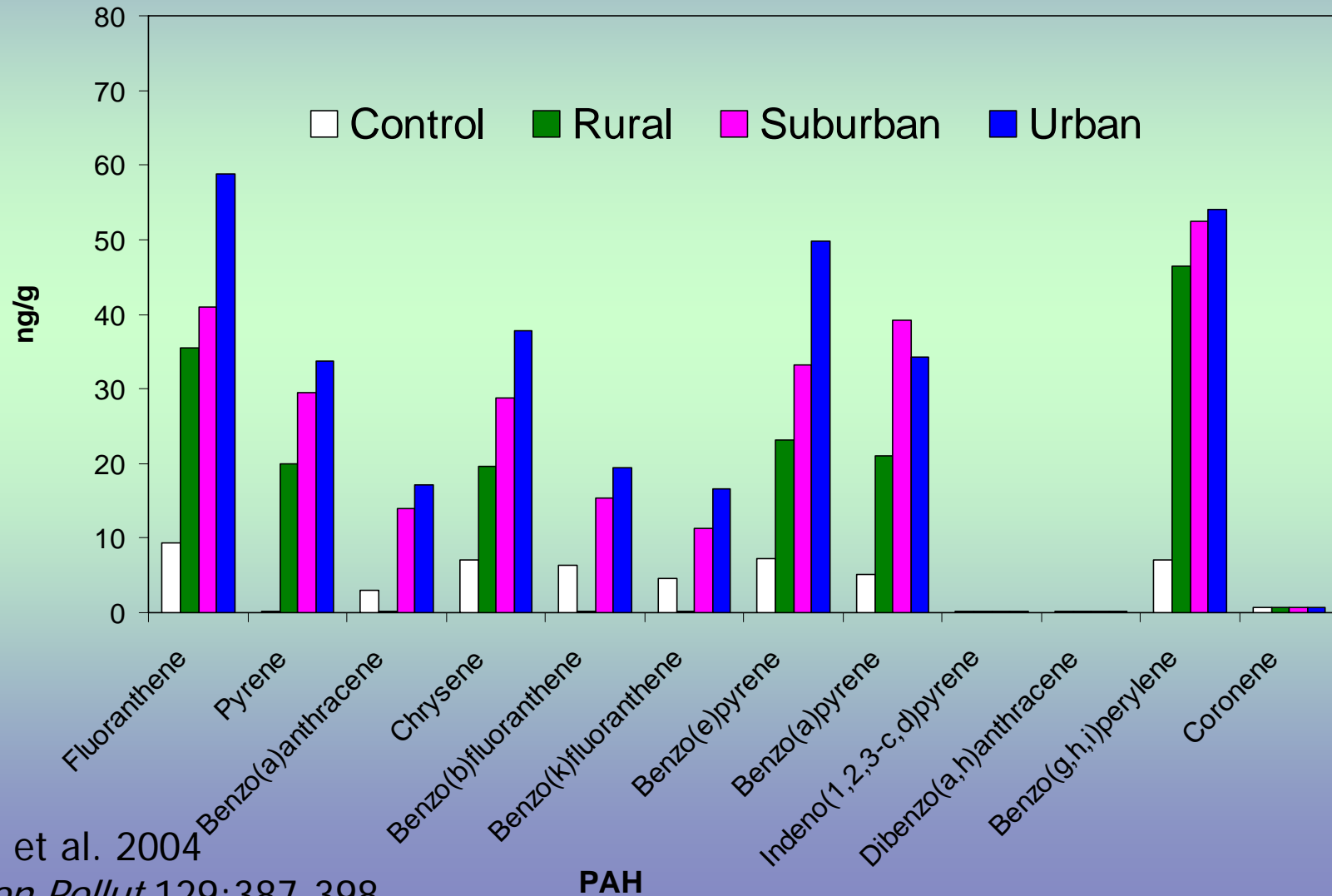
Soils and Sediments - OCP



rural

urban

Field Experiment Soils - PAH

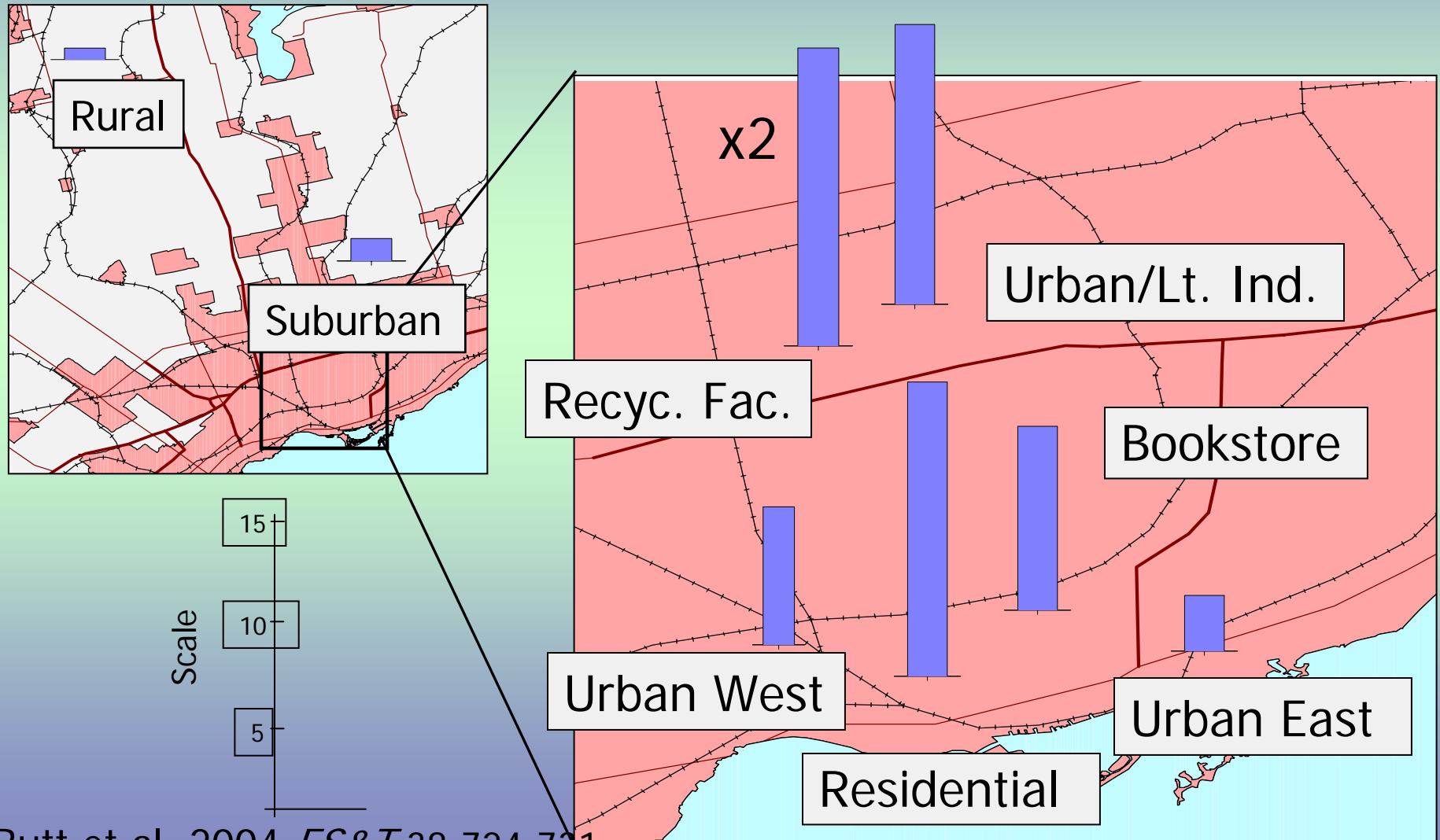


Wong et al. 2004

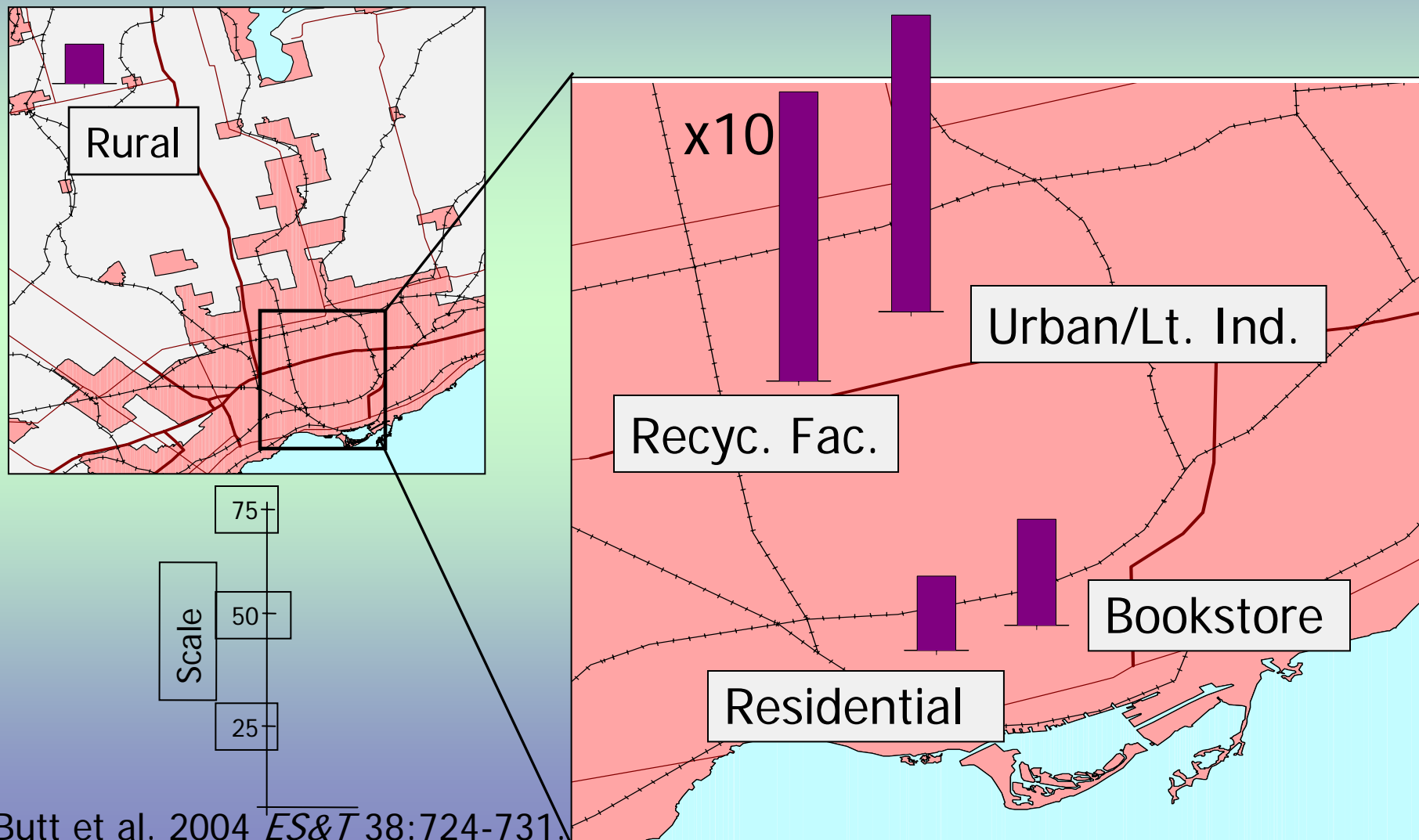
Environ Pollut 129:387-398.

PAH

PBDE Toronto: Outdoor Concentrations (ng/m²)

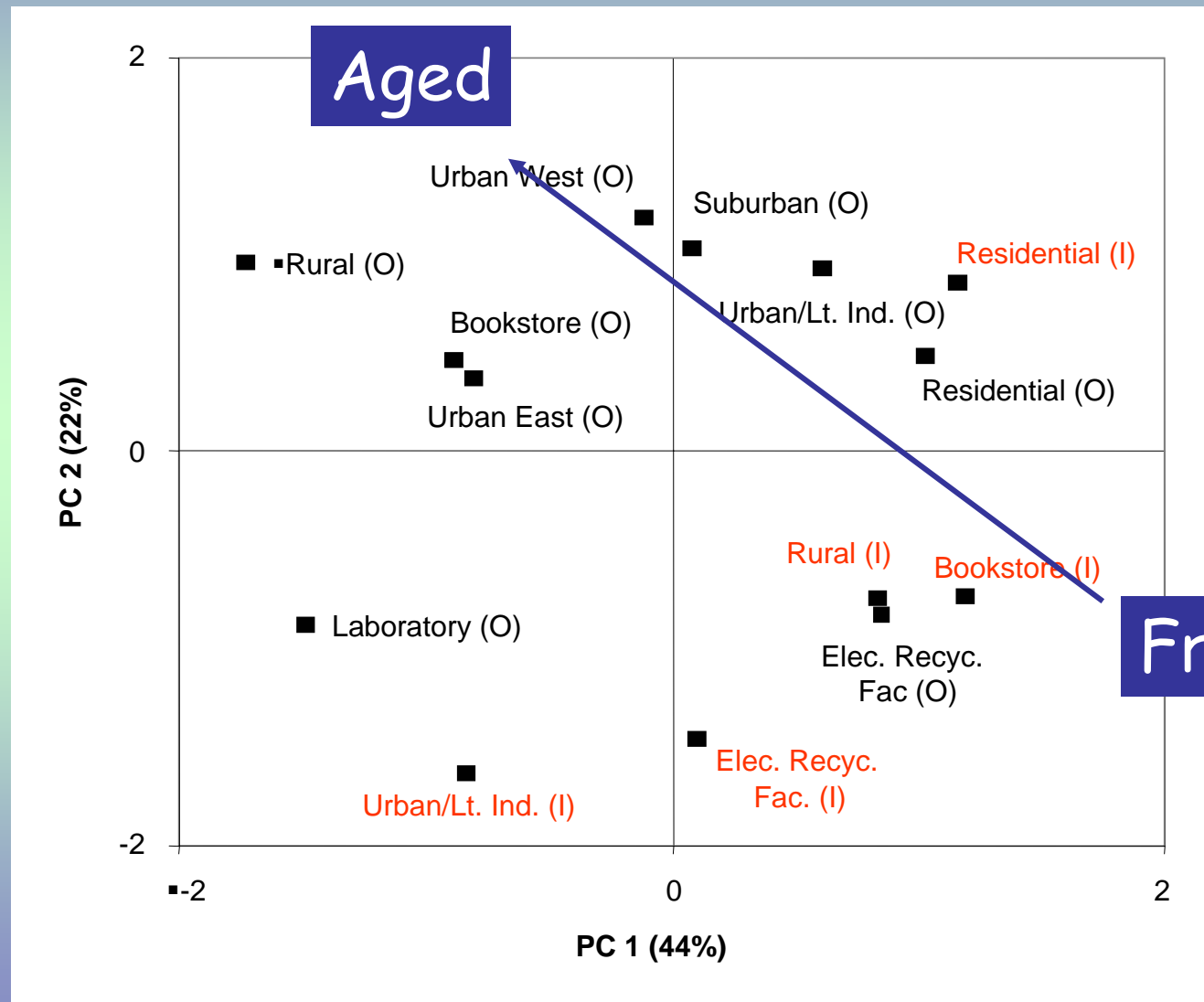


PBDE Toronto: Indoor (ng/m²)



Butt et al. 2004 *ES&T* 38:724-731.

PBDE Composition



Chemical Fate

Sink: Gas- & Particle-phase
Deposition
Reaction, transformation

Gas & particle emissions
Particle formation & growth

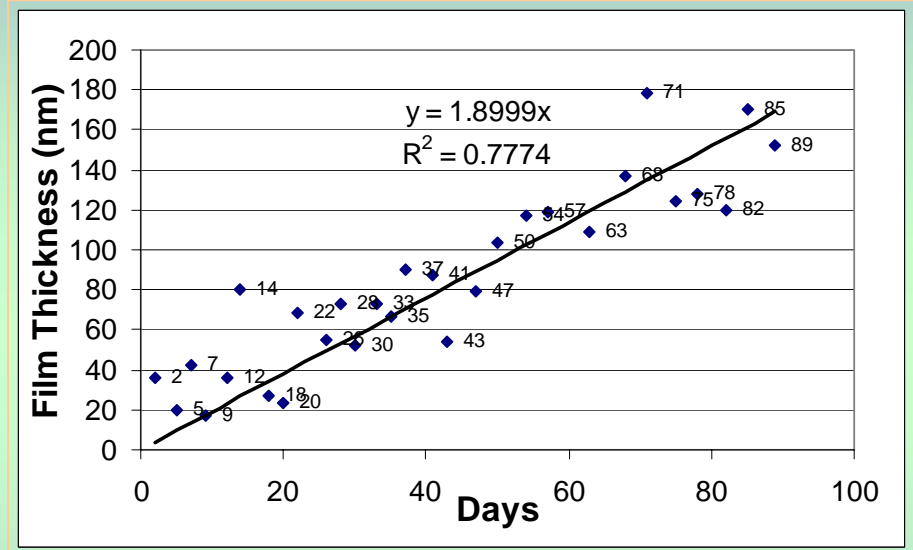
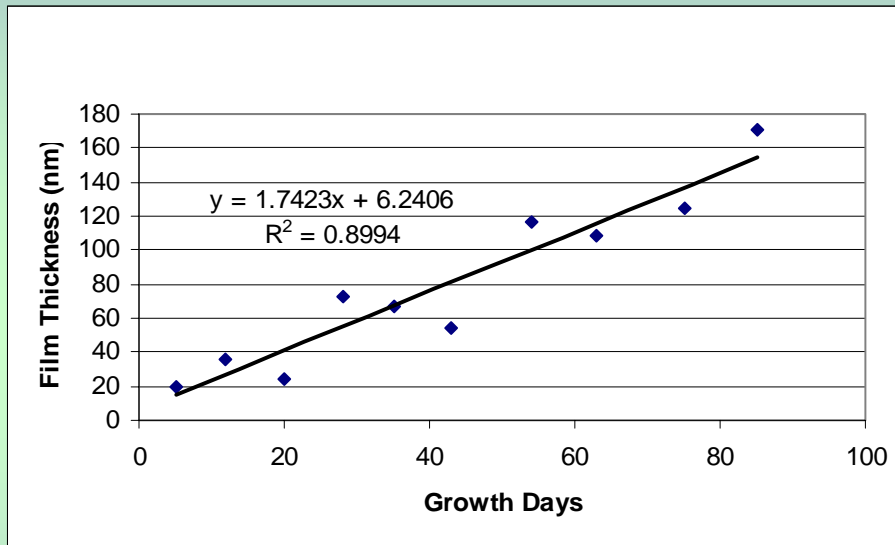
Source: Volatilization
of VOCs & SOCs



Transfer: Precipitation washoff

Wu, Harner, et al. 2005

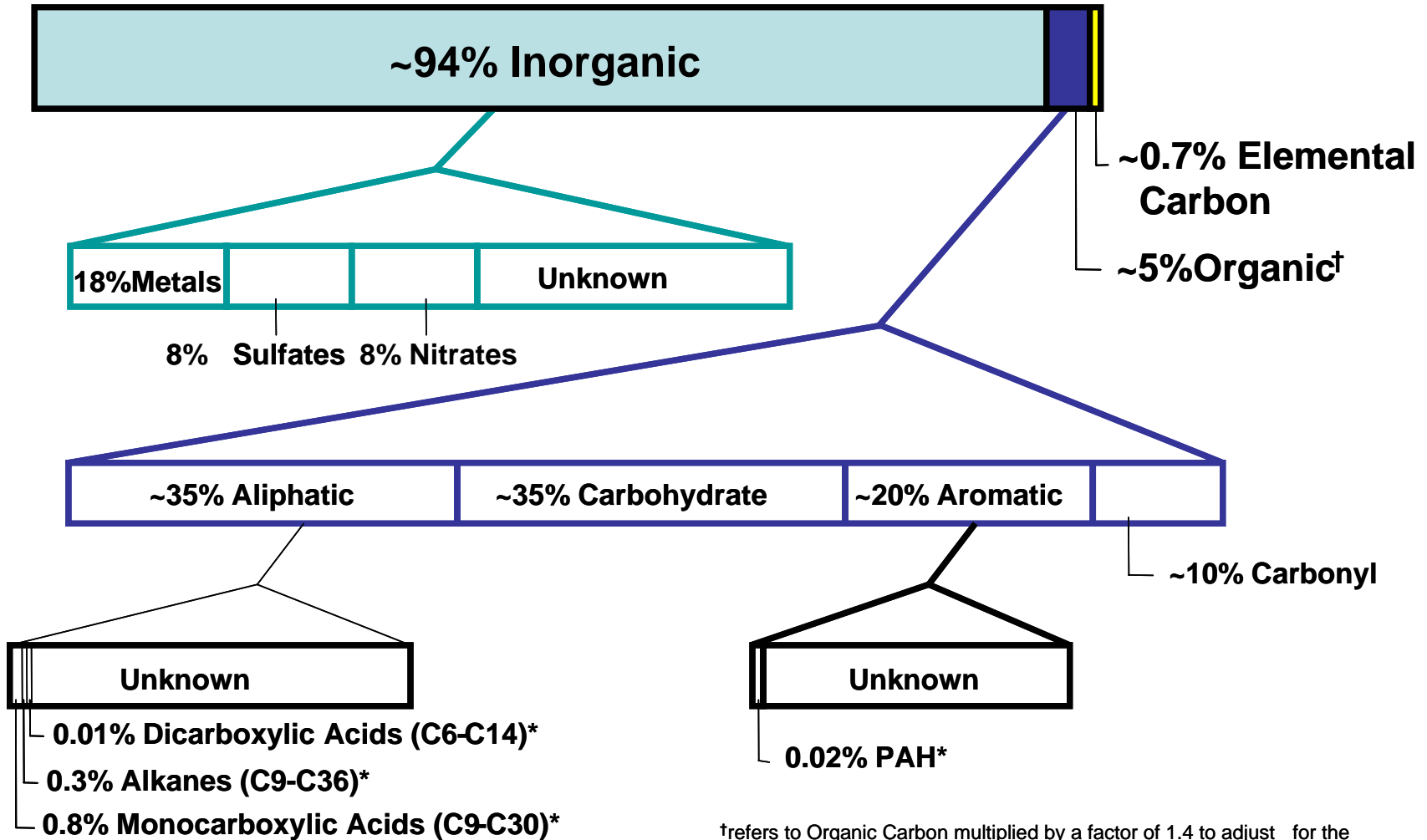
Film Growth



Film growth rate of ~ 2 nm/day

Butt et al. 2004 unpubl. data, Wu, Harner et al. 2005

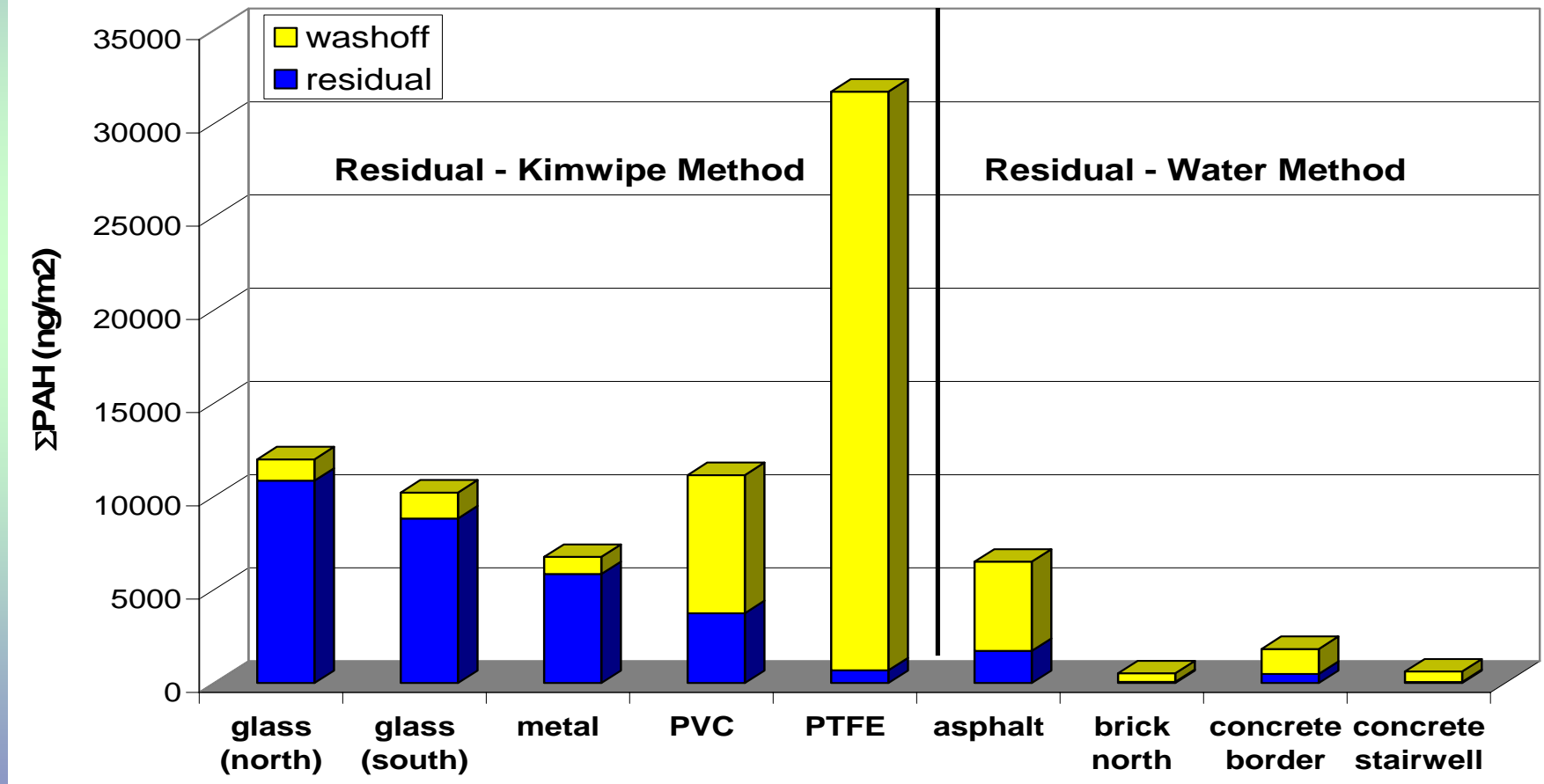
Mass Balance Of Urban Surface Films



[†]refers to Organic Carbon multiplied by a factor of 1.4 to adjust for the molecular form of carbon species

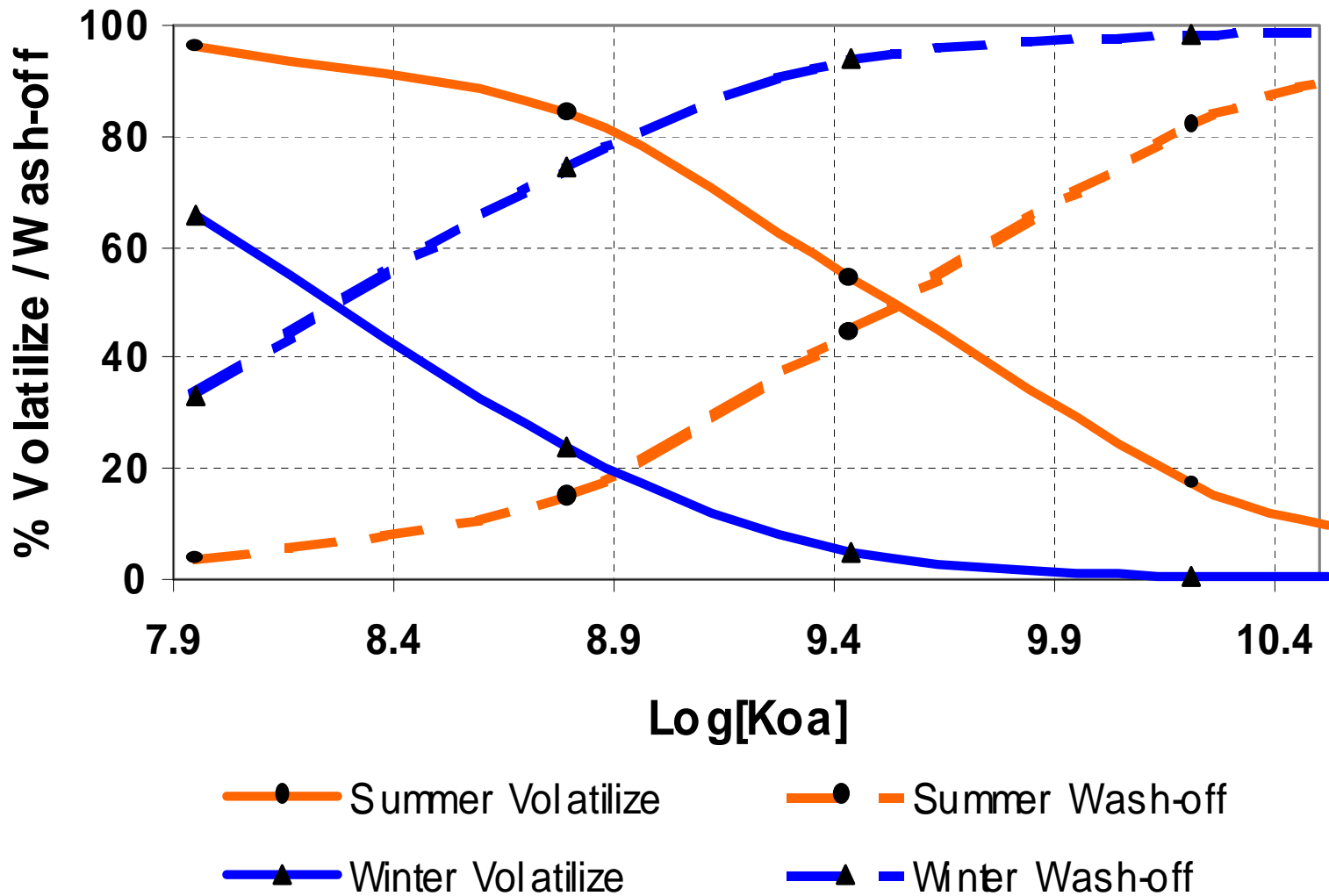
*values compiled from previous studies

Film Washoff

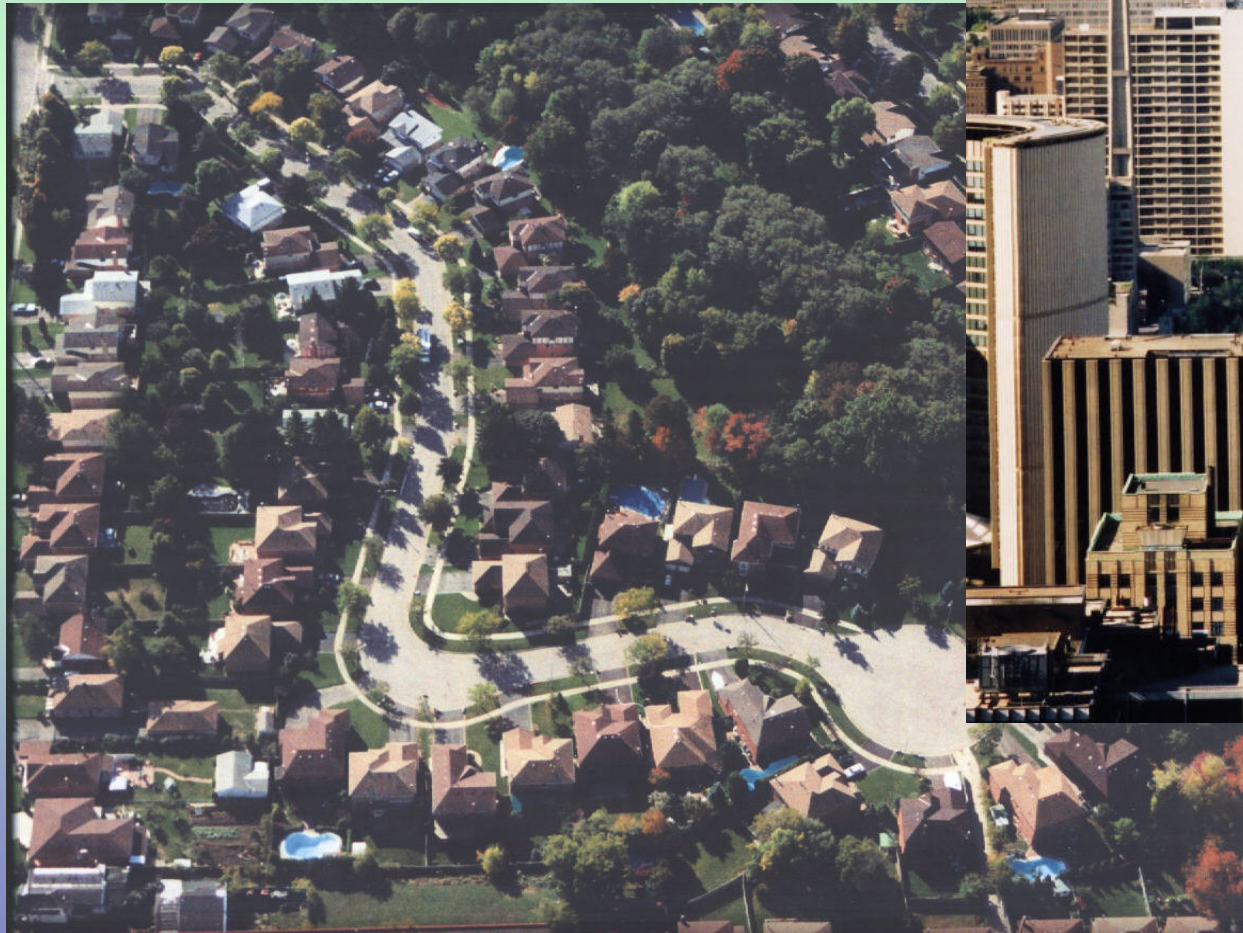


Labencki et al. *Chemosphere* in press.

Chemical Transport from Film

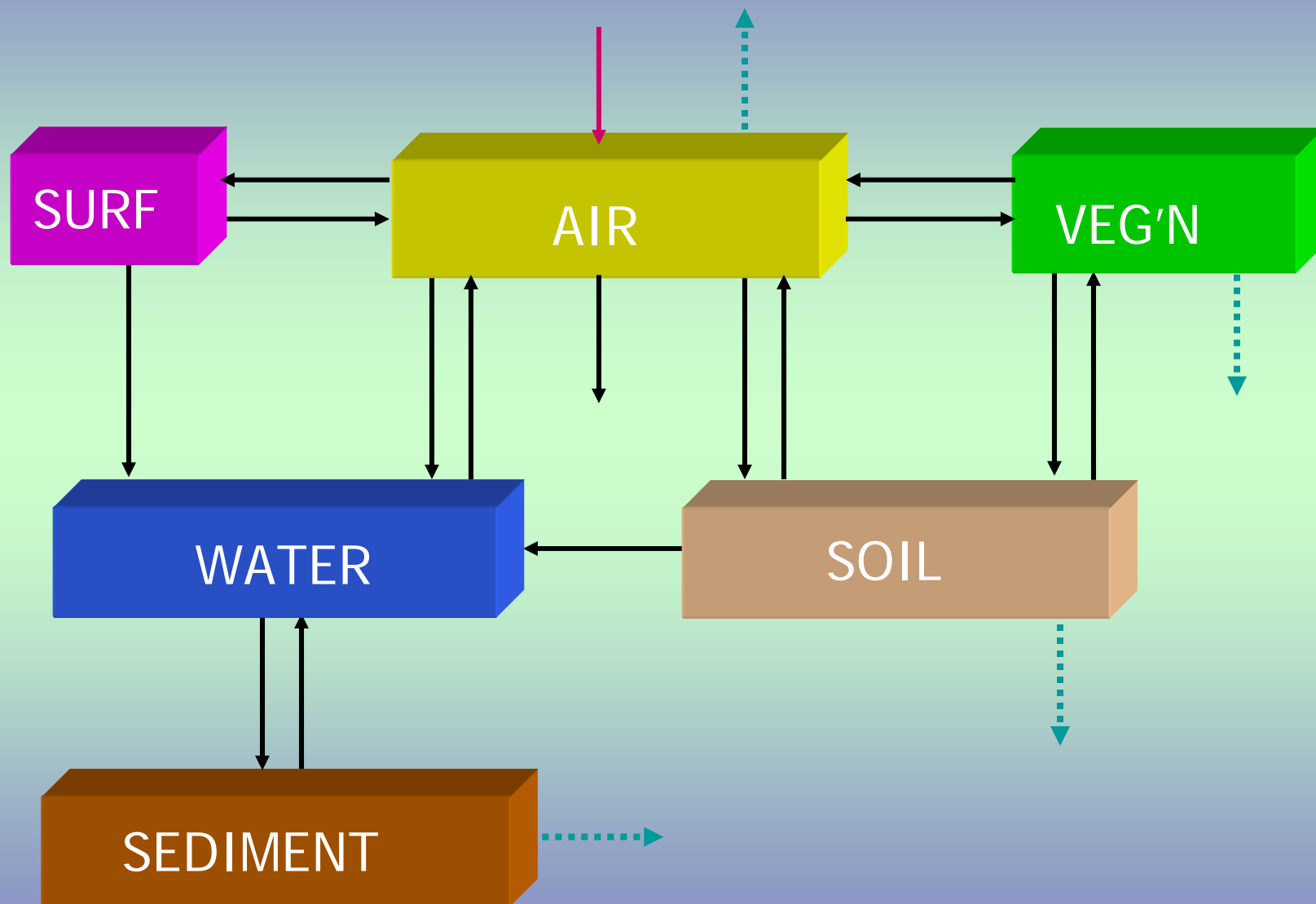


Greater Toronto Area

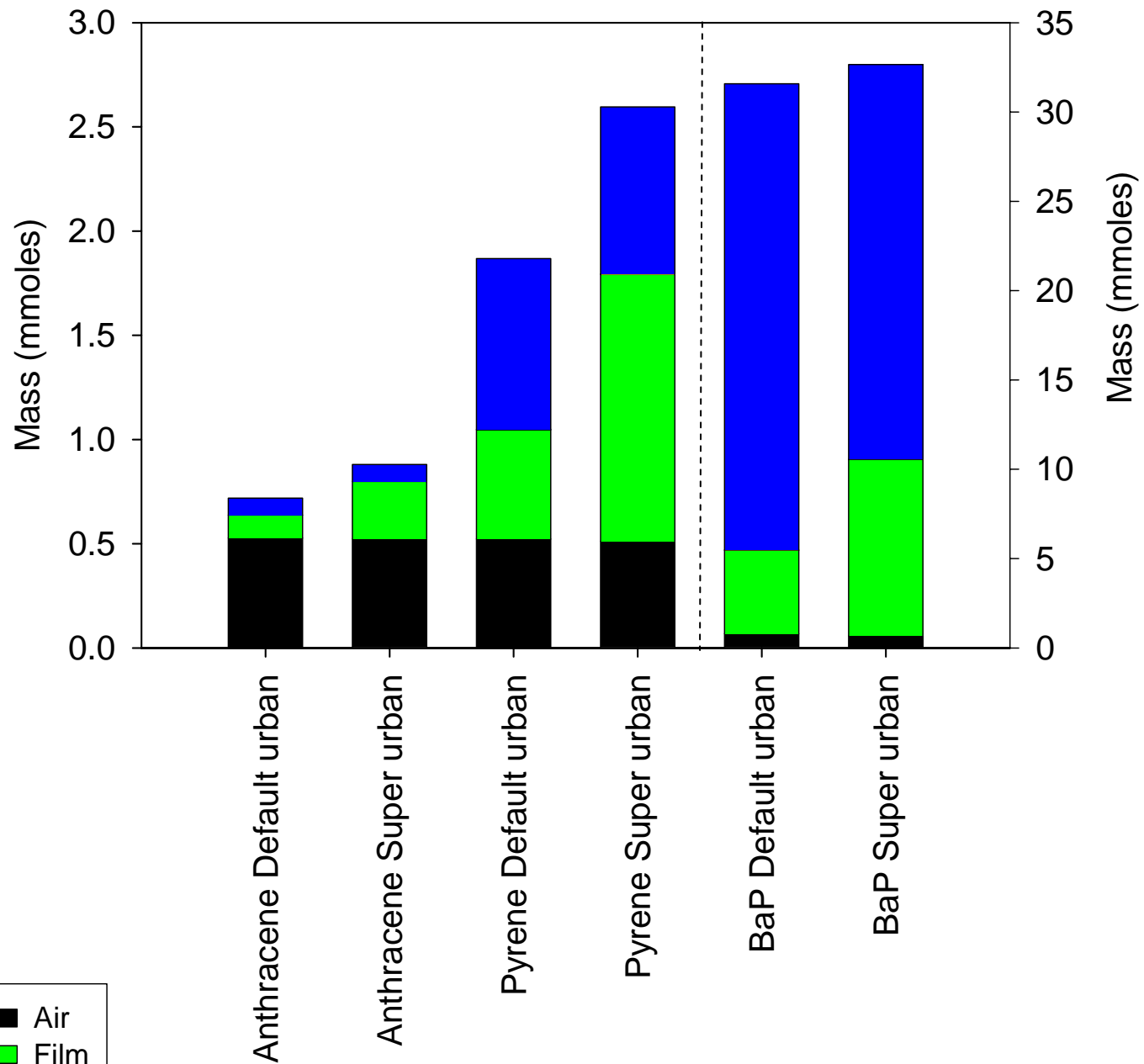


Photos, T. Labencki

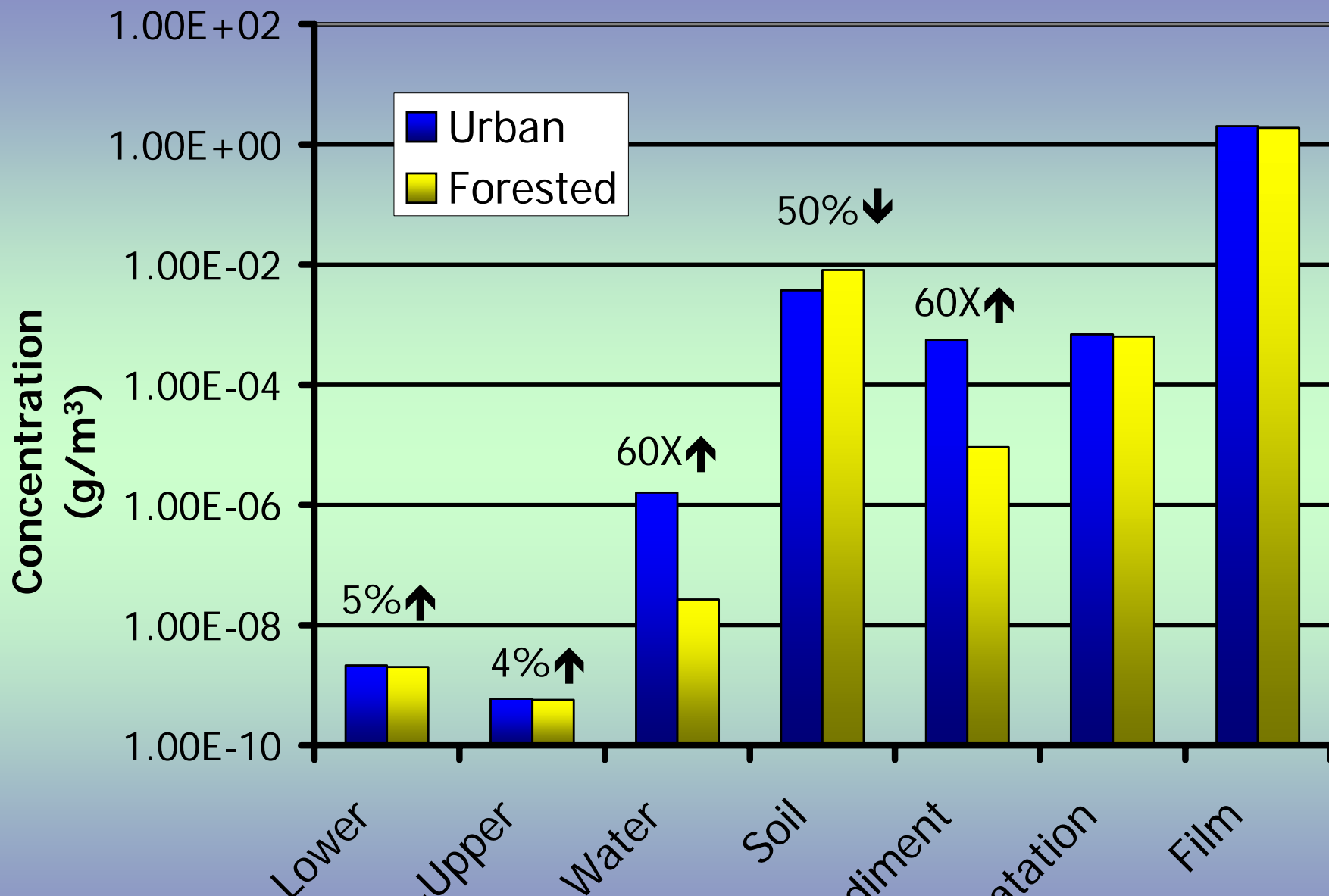
Multimedia Urban Model- Fate



Diamond et al. 2001 *Chemosphere* 44:1655
Priemer & Diamond 2002 *ES&T* 36:1004



Kwamena et al. submitted

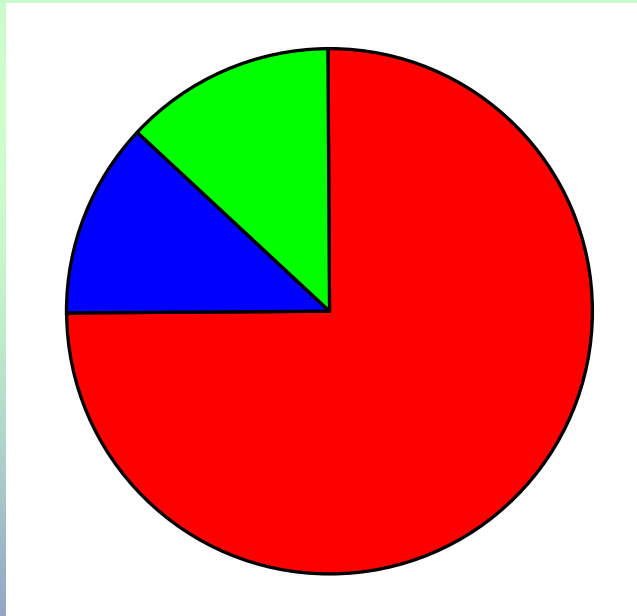


Clarke, unpub. data

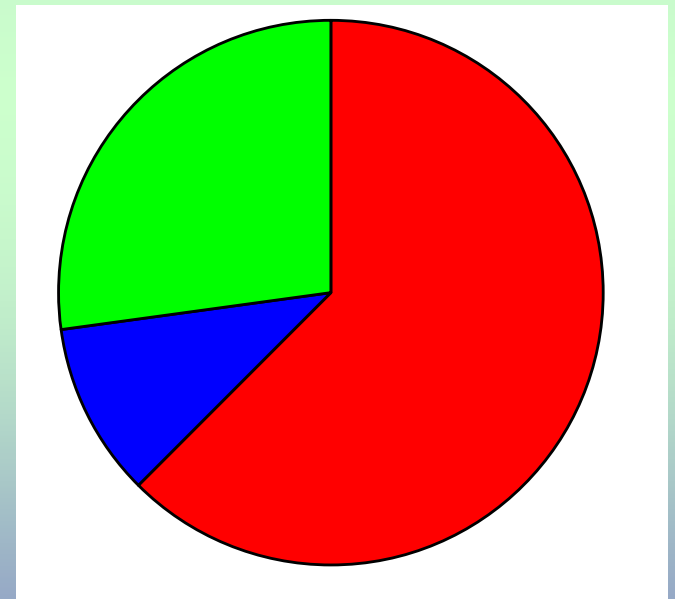
Chrysene

Role of Film: BaP

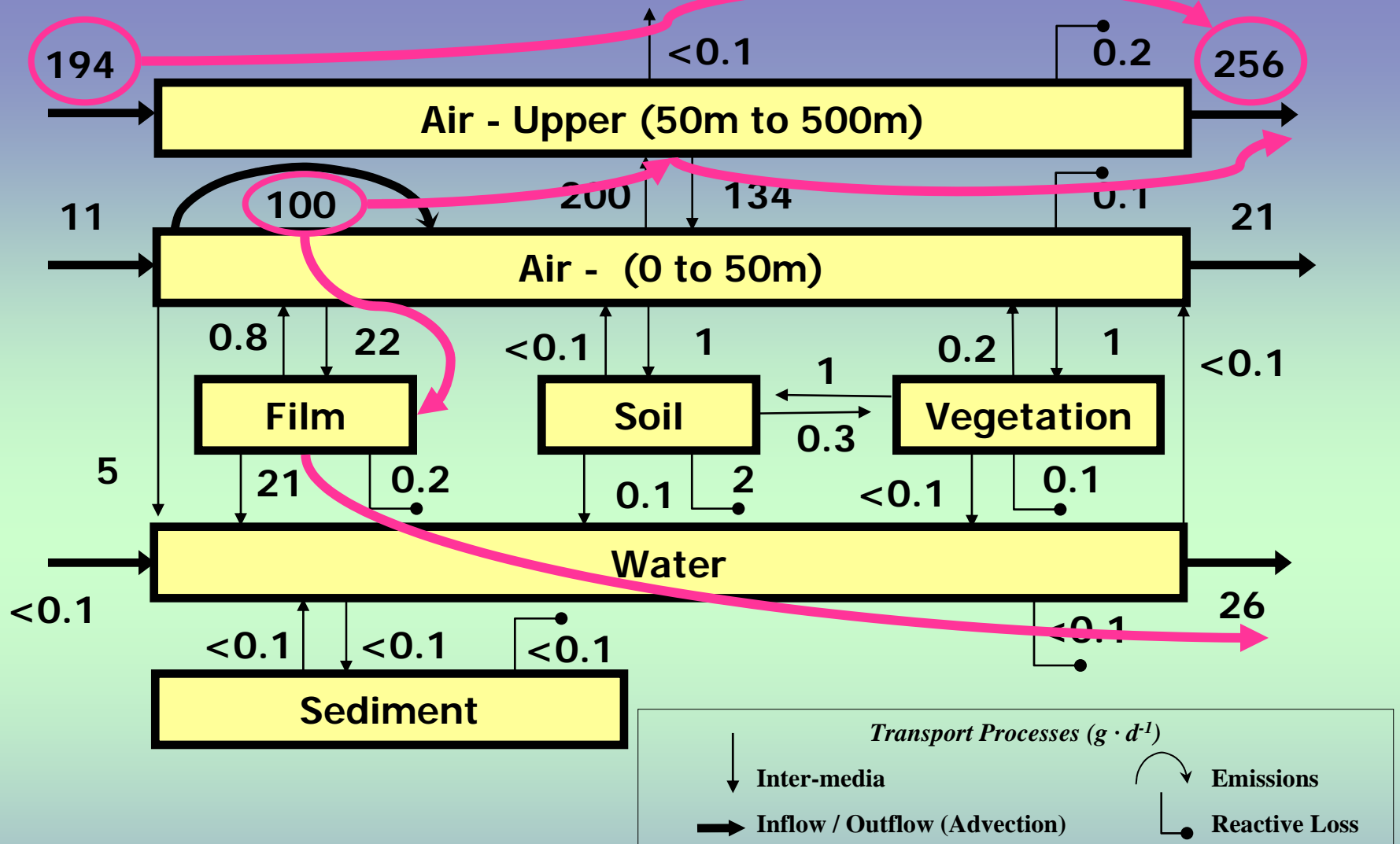
Urban Environment



Super Urban Environment

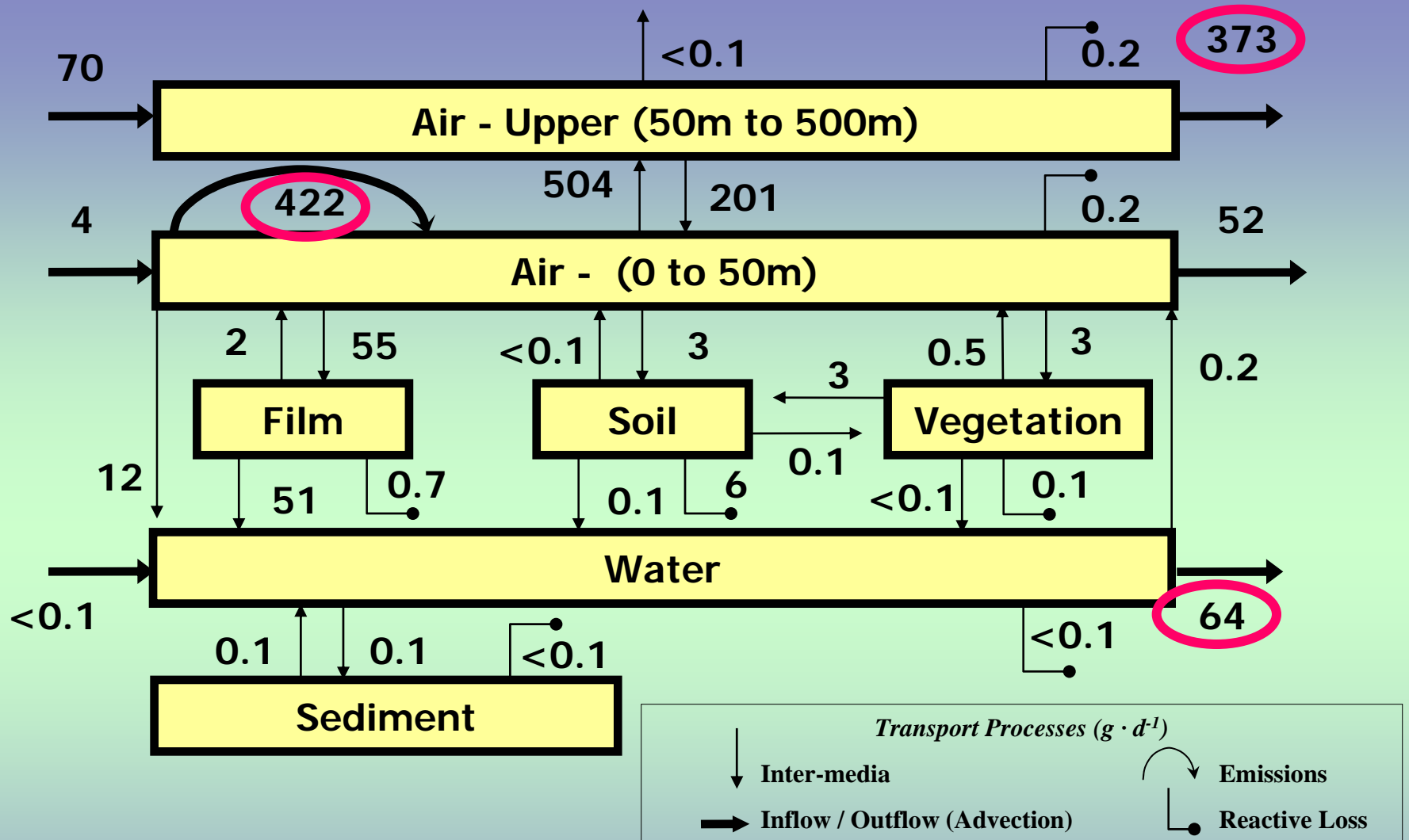


■ Air Lower Outflow
■ Air Lower Rxn
■ Film Rxn



Summer ($25^{\circ}C$)

Scenario 1: High Inflow + Low Input = Low Output

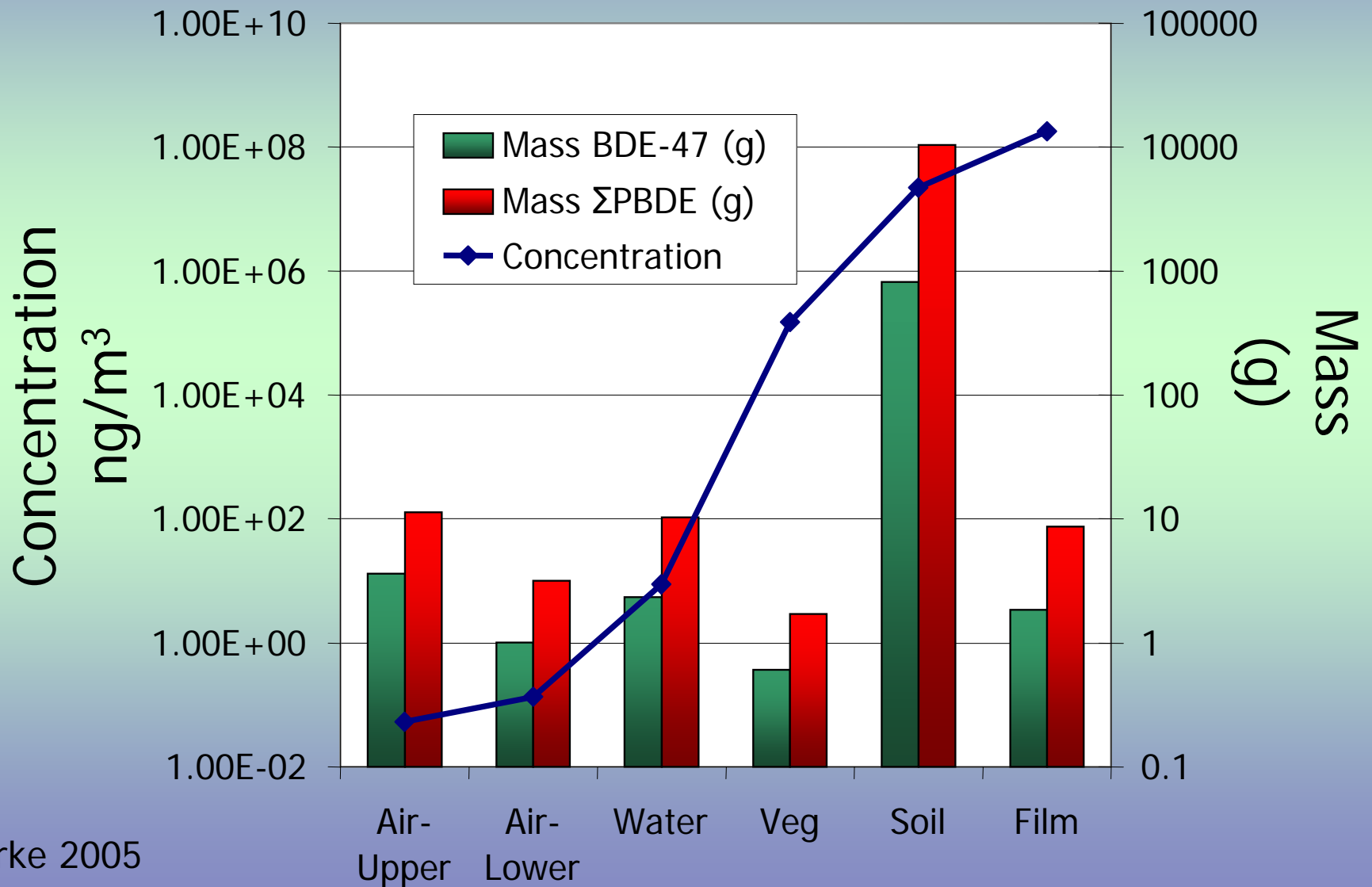


Jones-Otazo et al. 2005 *EST* 39: 5121-5130

Summer (25°C)

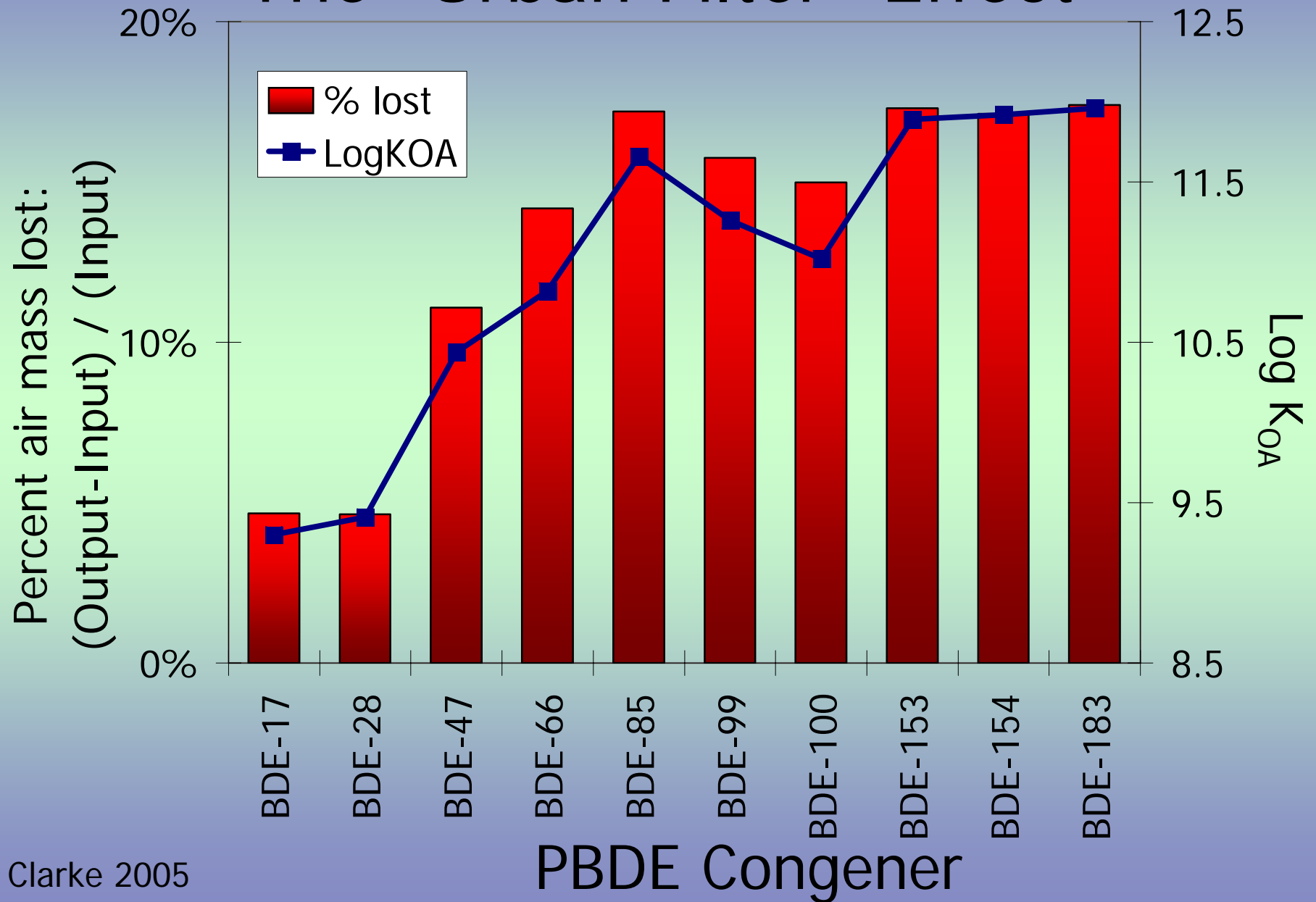
Scenario 1: Low Inflow + High Input = High Output

PBDE: Concentration and Mass



Clarke 2005

The "Urban Filter" Effect



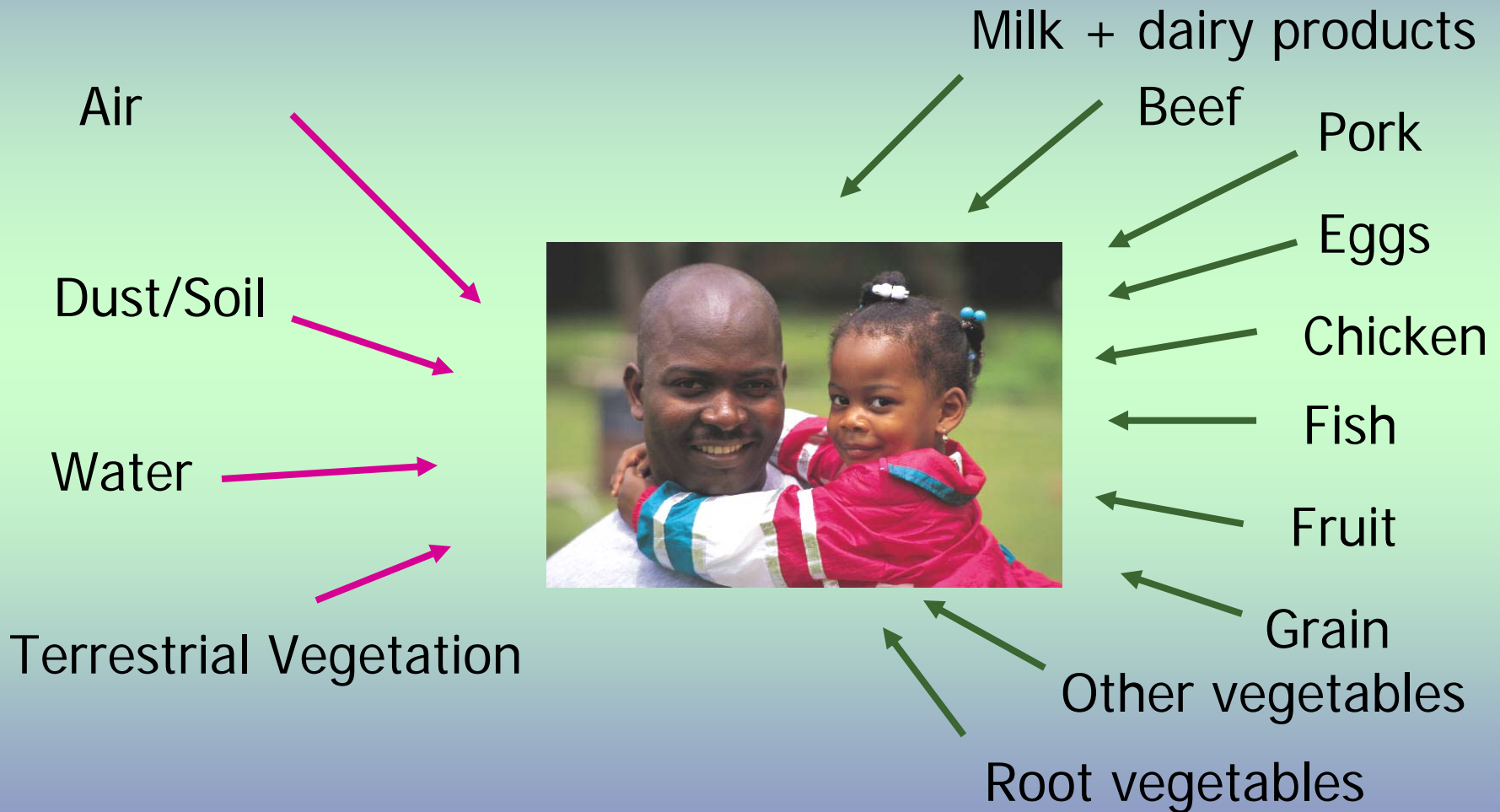
Clarke 2005

Emissions

	PBDEs	PCBs
Mg/capita/yr	20-118	54-1485
$\mu\text{g}/\text{m}^2/\text{yr}$	0.2-0.9	0.4-11

Jones-Otazo et al. 2005 *EST* 39: 5121-5130; Clarke et al. in prep.

Human Exposure



MUM-Fate

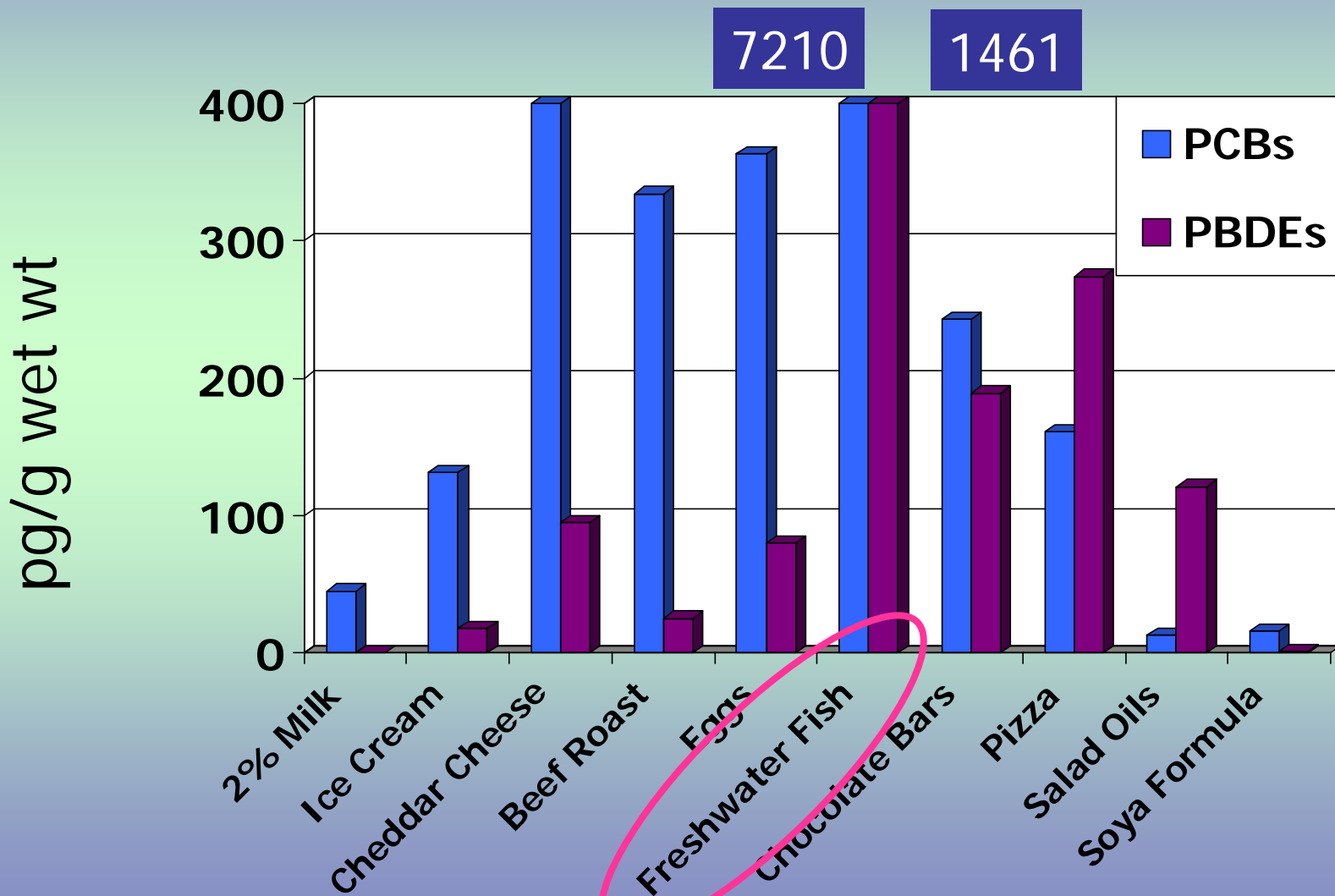


MUM-FAMexposure



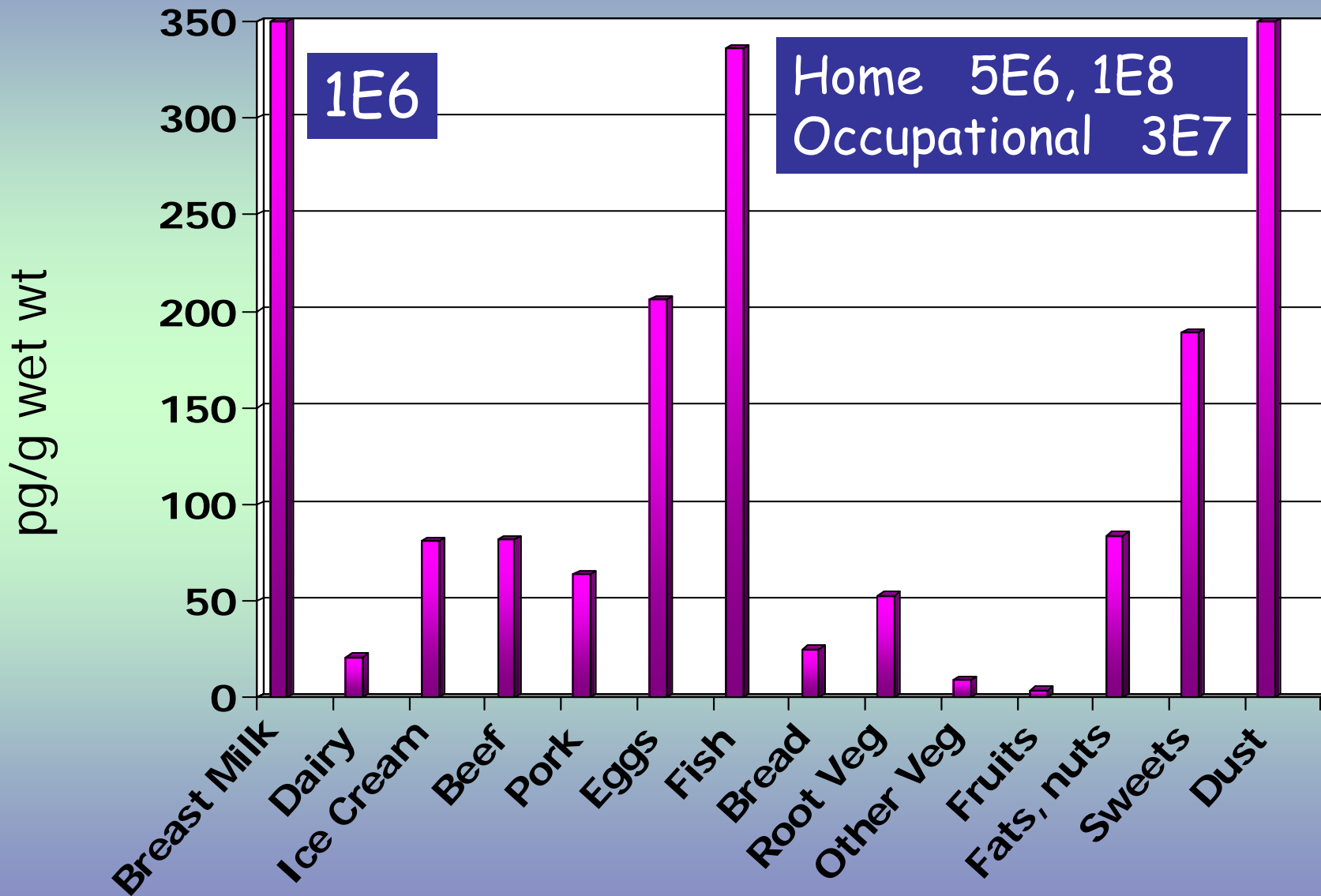
MUM-FAMrisk

PCBs & PBDEs in our Diet



Total Diet Study, Health Canada. Vancouver 2002.

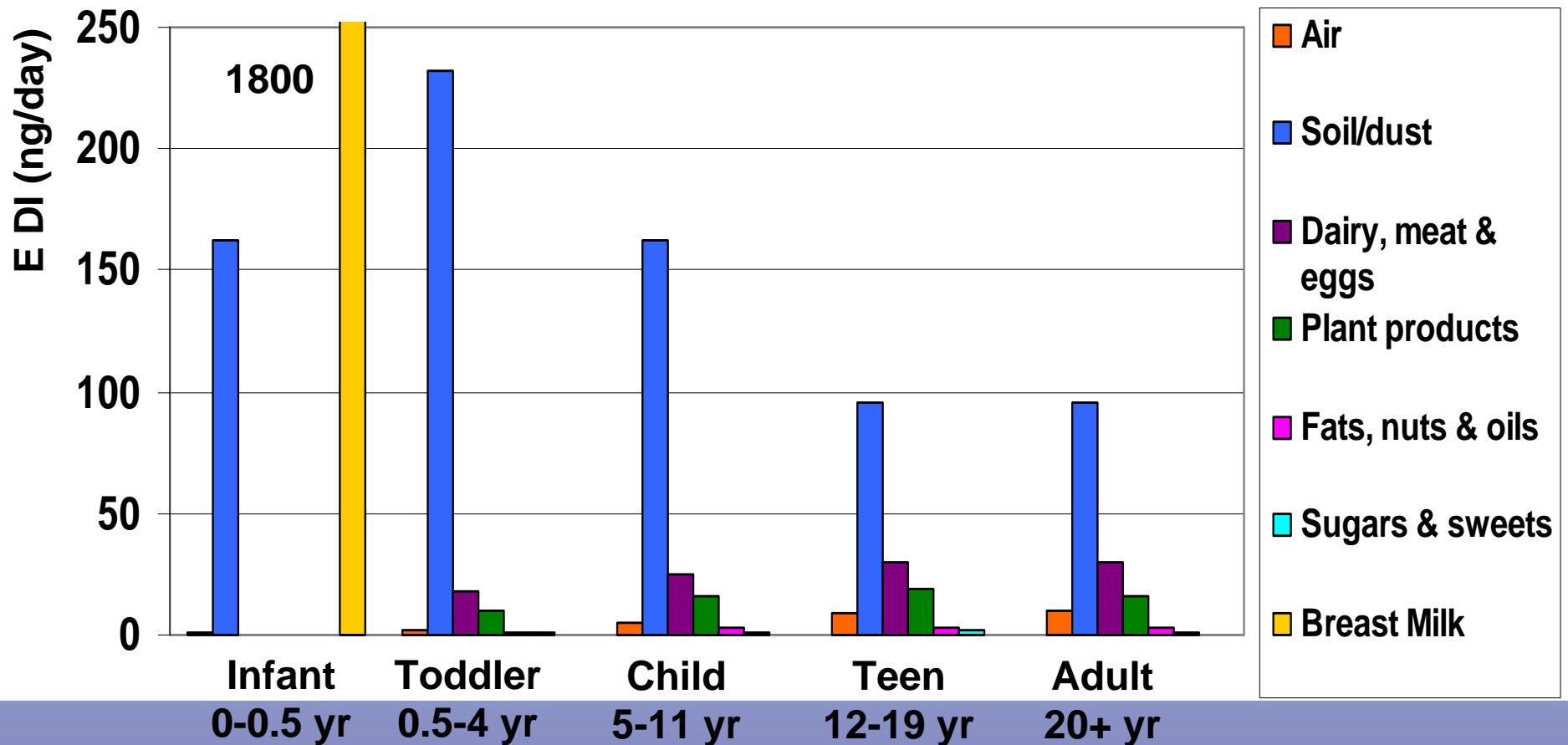
GPBDE Concentrations



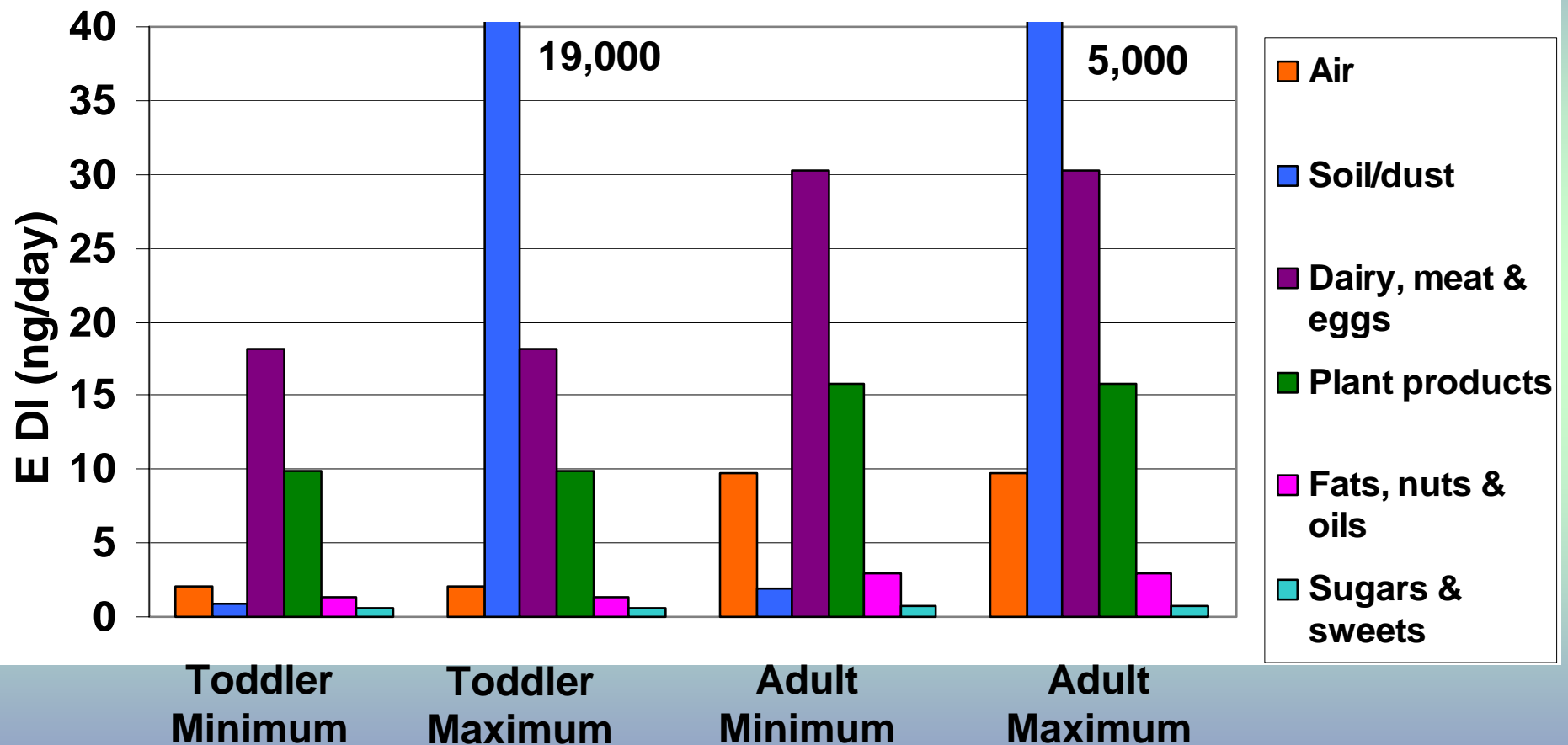
Total Diet Study, Health Canada. Vancouver 2002.

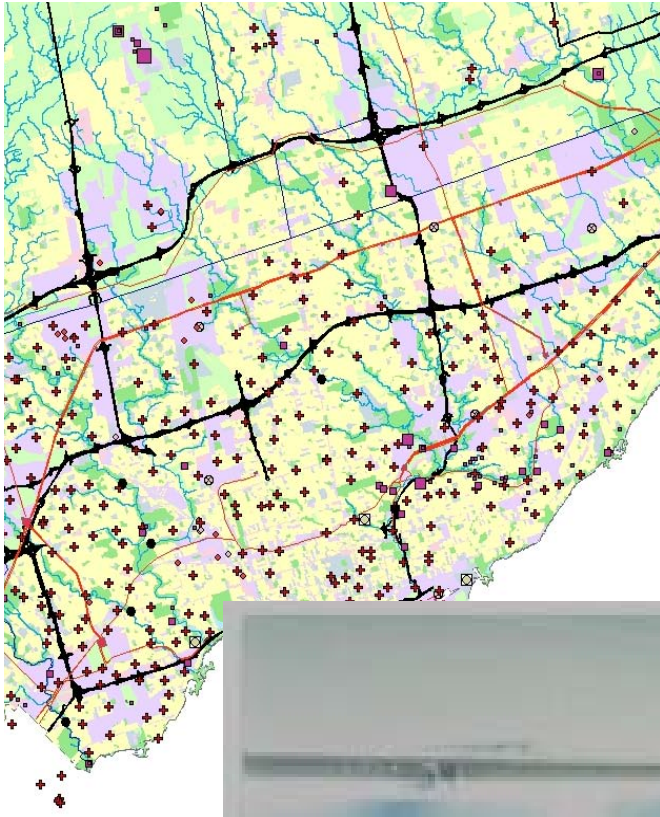
PBDE "Average" Canadian Exposure

24-28,680



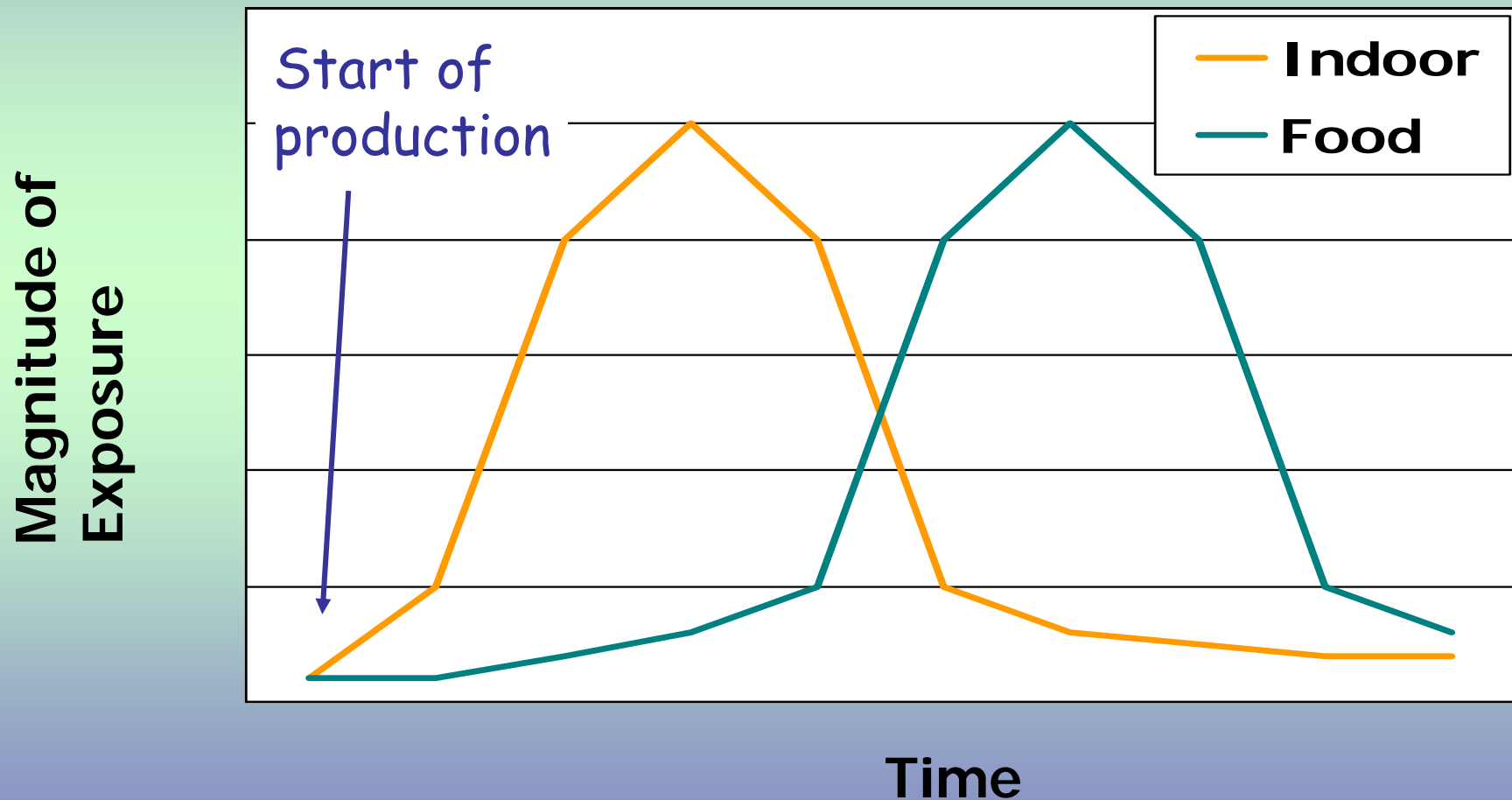
PBDE: Exposure Extremes



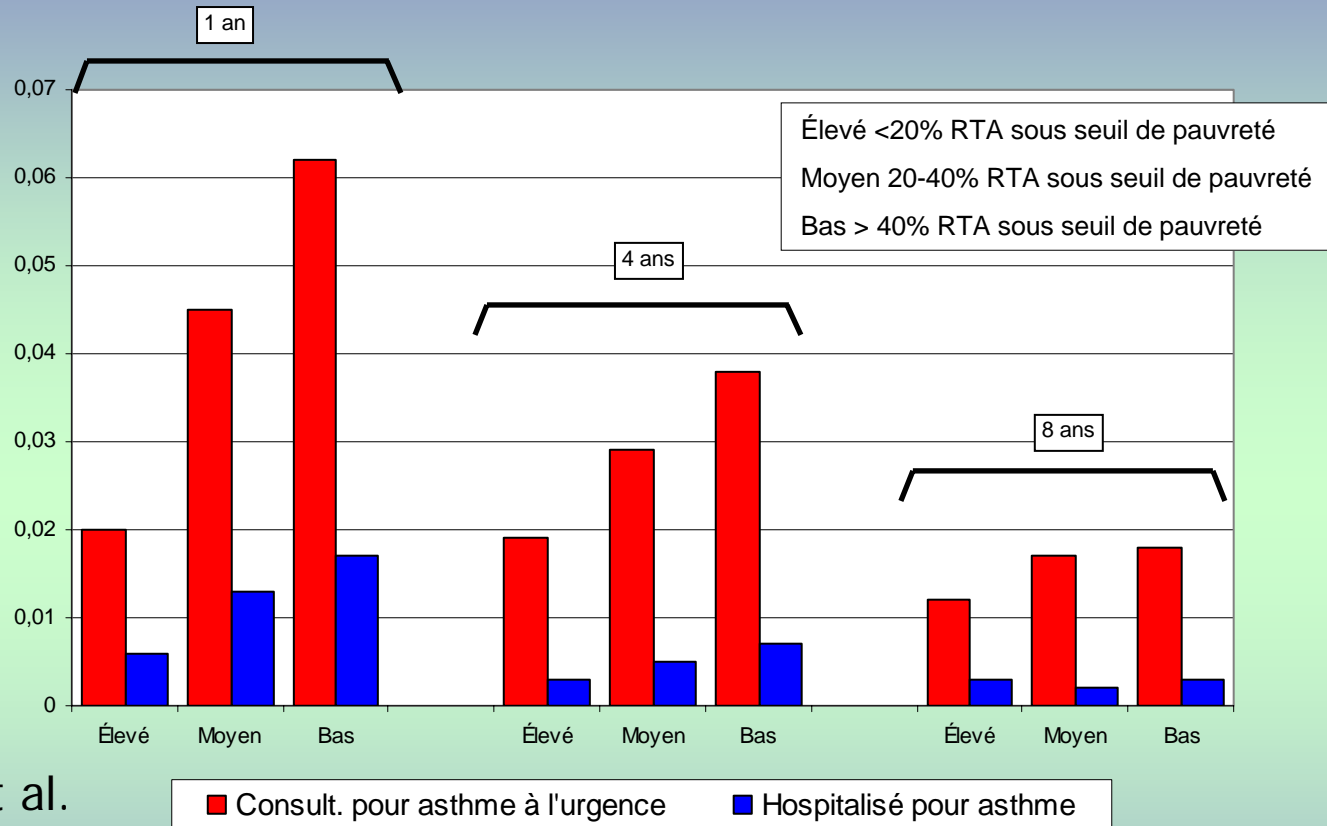


Contaminant Exposure

e.g., PCBs, PCDD/F, PBDE

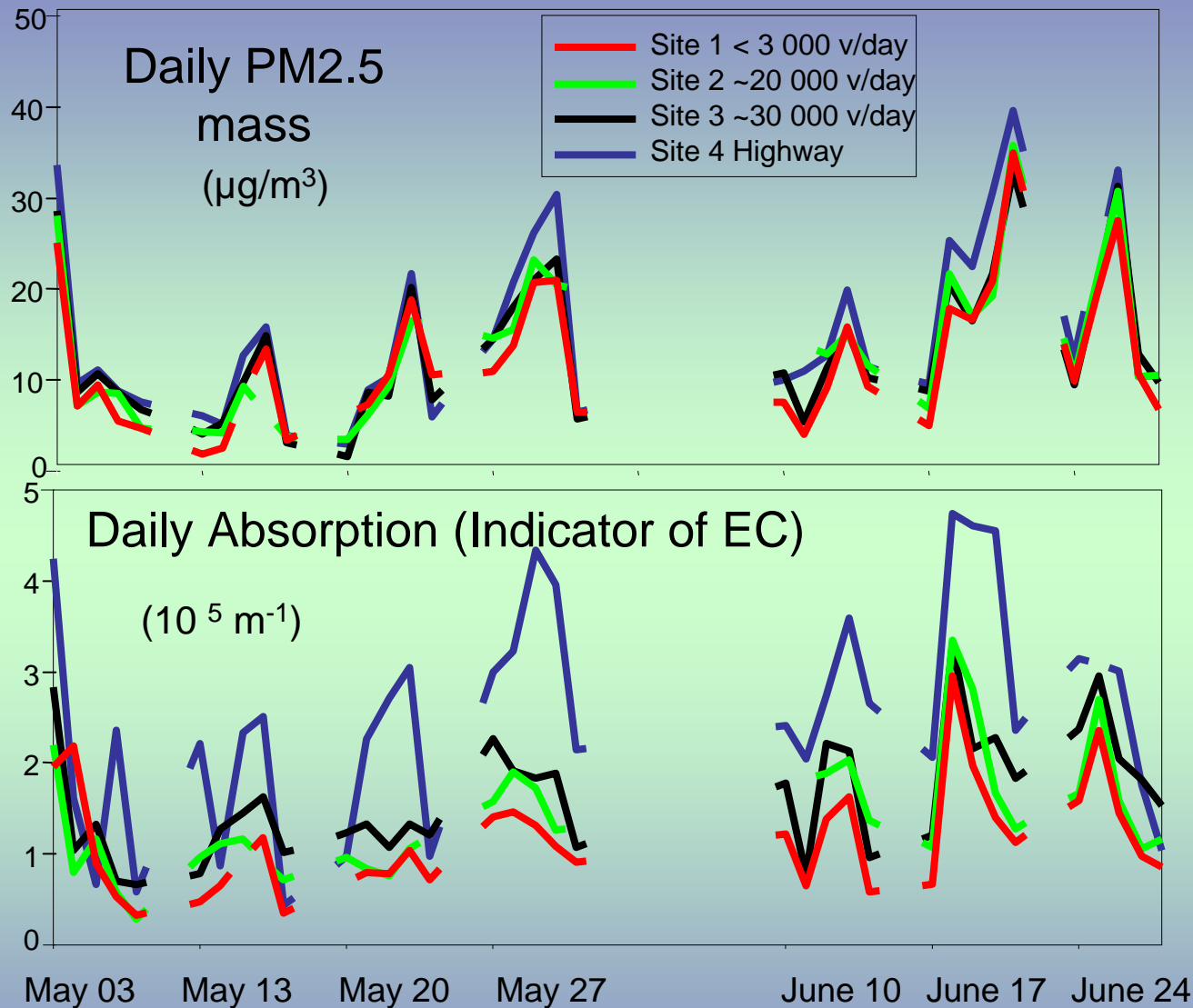


Proportion des enfants montréalais ayant consulté à l'urgence ou hospitalisés pour asthme, selon l'âge et le statut socio-économique (Kosatsky et Labrèche, 2002)



Smargiassi et al.
In press.



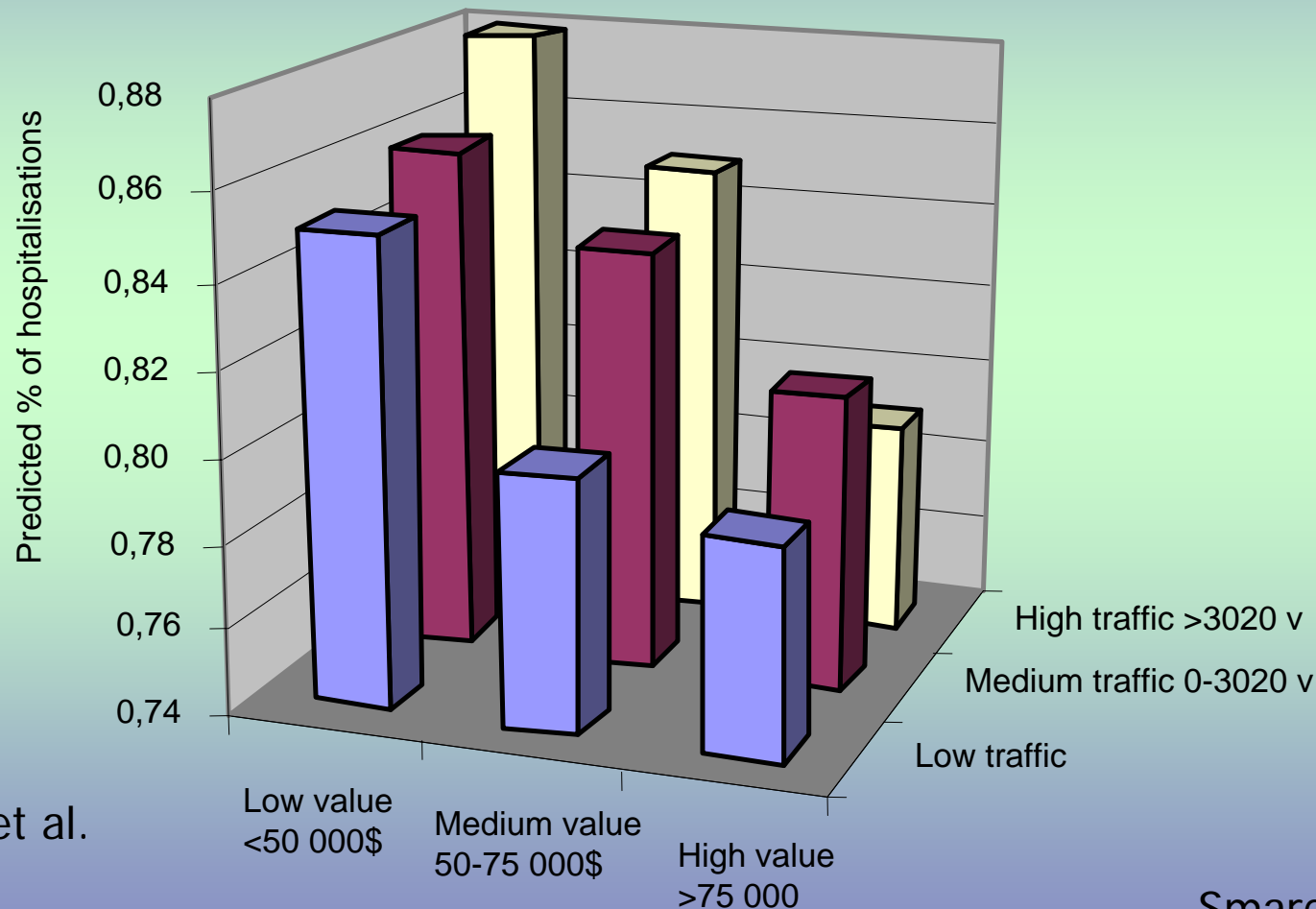


Smargiassi et al.

In press

- Some studies suggest that EC + NO₂ indoors levels may vary with traffic intensity (e.g. Kramer et al., 2000; Gotschi, 2002)

Risk of being hospitalised for respiratory vs genito-urinary problems, with varying traffic intensities and housing values in Montreal†



Smargiassi et al.
In press

Smargiassi et al.

Predicted % for respiratory problems are adjusted for age and gender / maybe appropriate to consider low value for ≠ types of buildings

Contaminant Exposure Model



Urban

- Large stock - flows
- 5-20X
- Hotspots
- Impervious surfaces - fate

Pathway

- Usage profiles
- Location & time

Toxicology

- Complex mixtures
- Complex pathways
- Cascade of effects

Socio-economic Status

- Interactive effects

Funding

NSERC

C4

PREA

CRESTech

People

- Stuart Harrad, Univ of Birmingham
- Patricia Harper, Sick Kids Hospital
- Audrey Smargiassi, Montreal Public Health
- Michael Ikonomou & Gary Stern, Fisheries & Oceans

