Biocides in urban stormwater - catchment-specific differences and city-wide loads

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be Berlin
Senatsverwaltung für Stadtentwicklung und Umwelt

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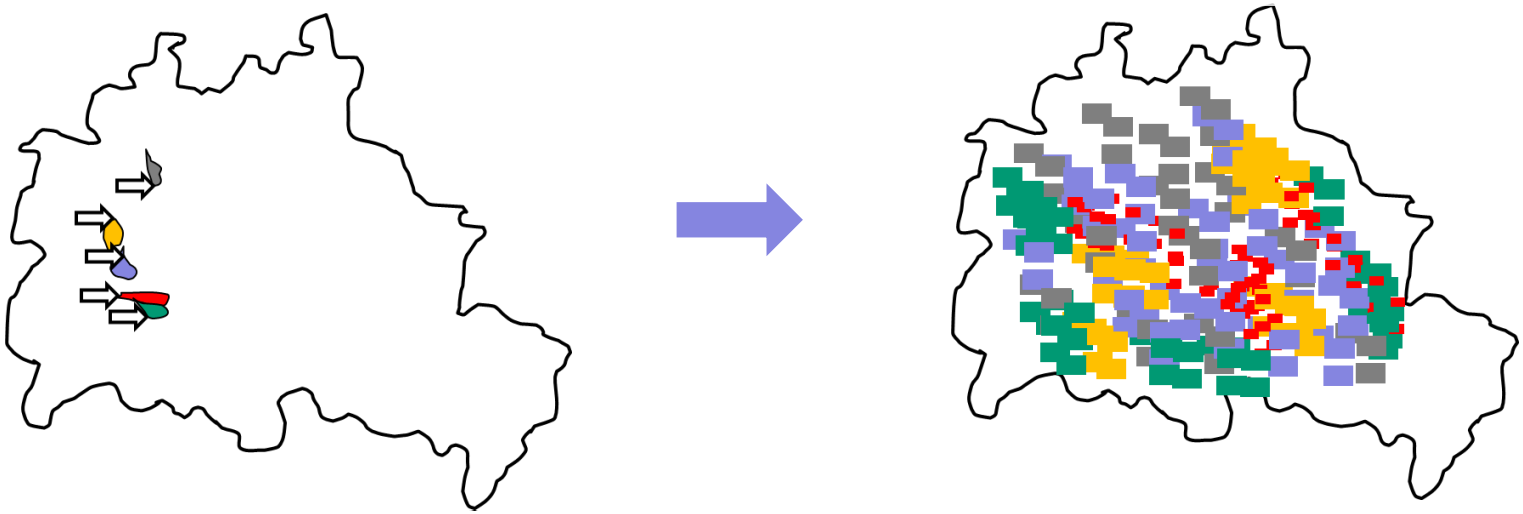
OGRE – Micropollutants in urban stormwater

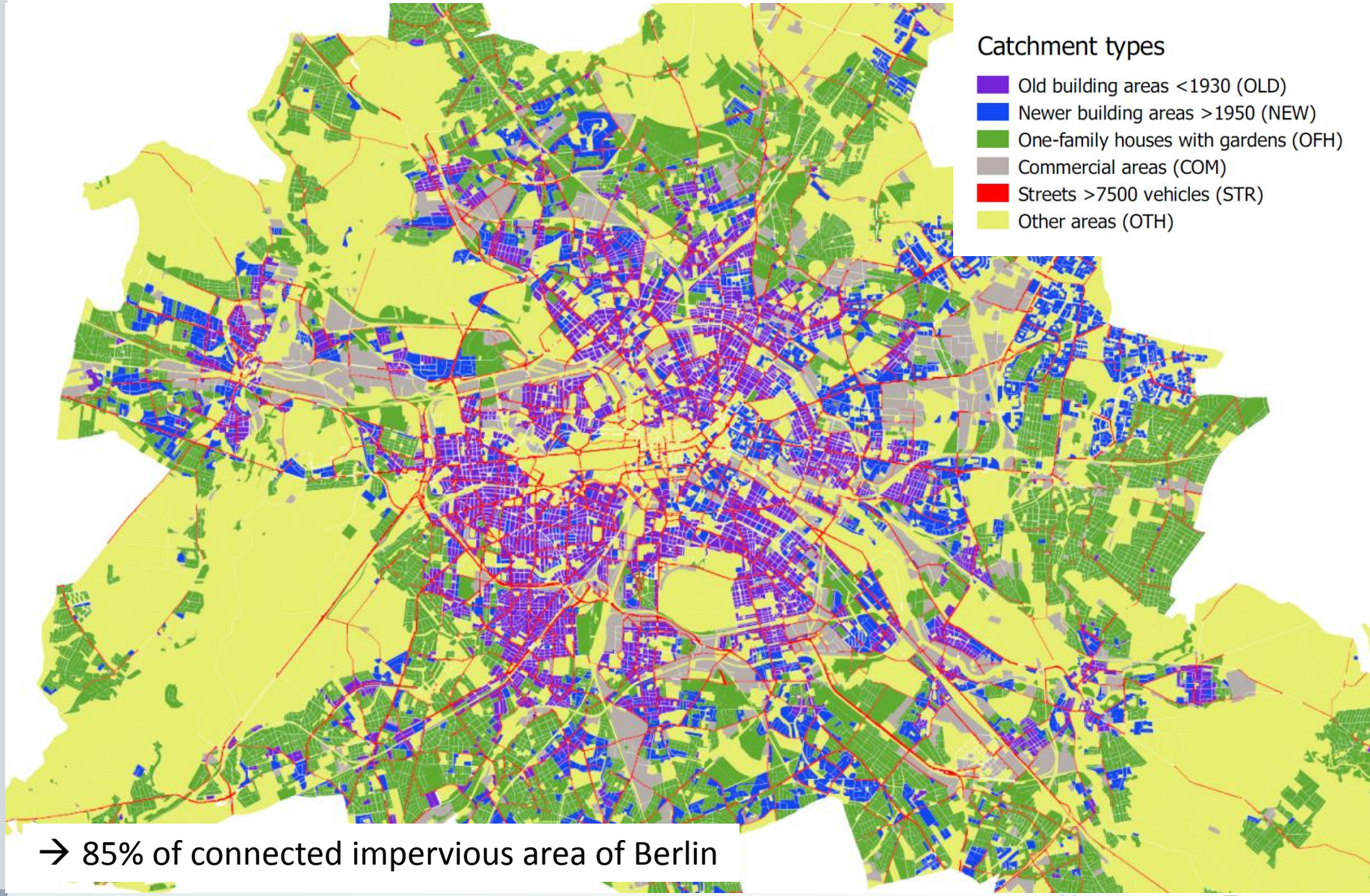
Questions:

- Main micropollutants in Berlin stormwater?
  - ► Monitoring: one year in 5 storm sewers of different catchment types (event mean c)
- Loads on city scale?
  - ► Modeling: Extrapolation to estimate citywide loads
- Peak concentrations in receiving rivers?
  - ► Monitoring: one year in urban river (peak concentrations)

→ Relevance compared to other pollutant inputs (e.g. WWTP)



Approach

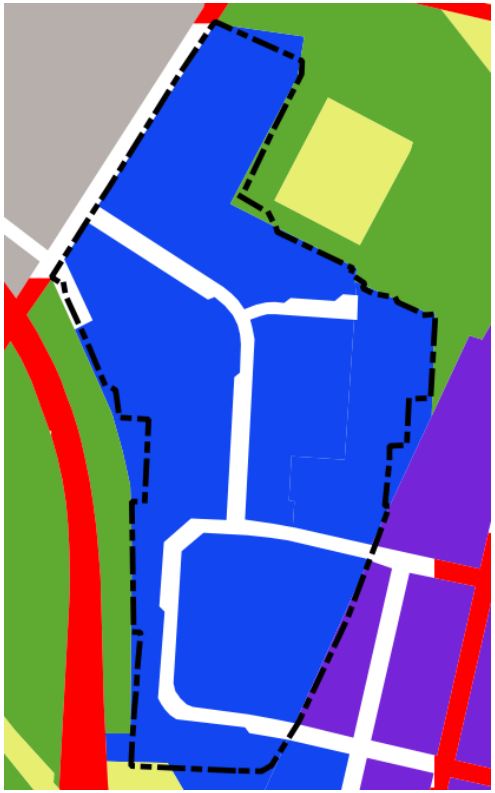


→ 85% of connected impervious area of Berlin

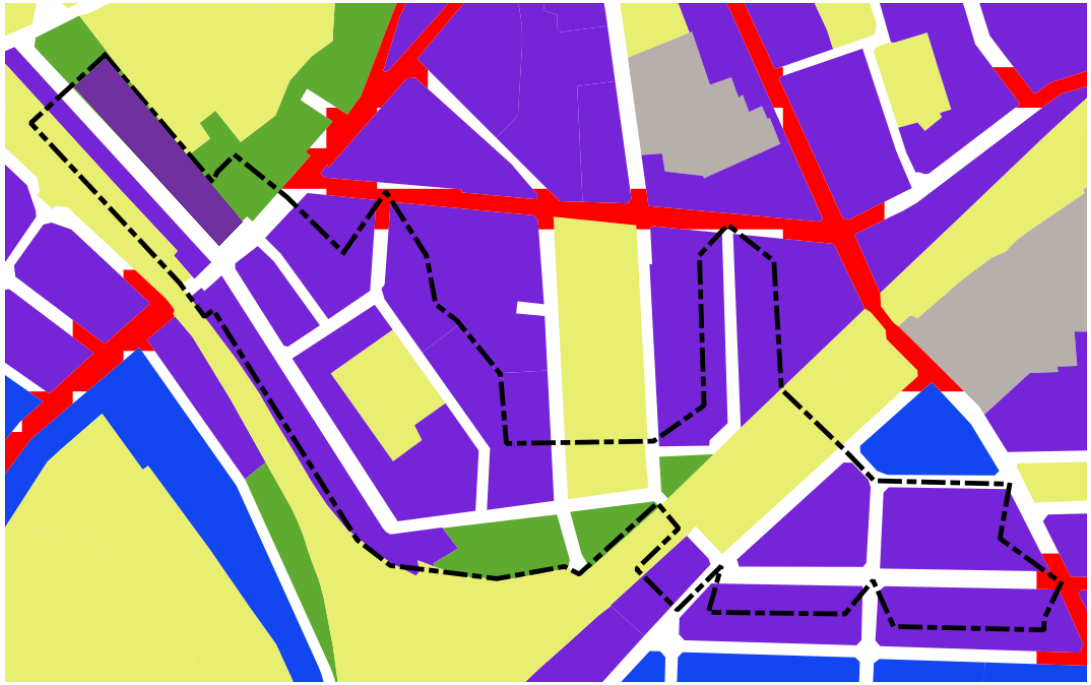
Approach

- **Find monitoring sites in separate stormwater sewers with one predominant city structure type**

Example „NEW“:
6 ha conn. imp. area
99 % type NEW



Example „OLD“:
12 ha conn. imp. area
87 % type OLD

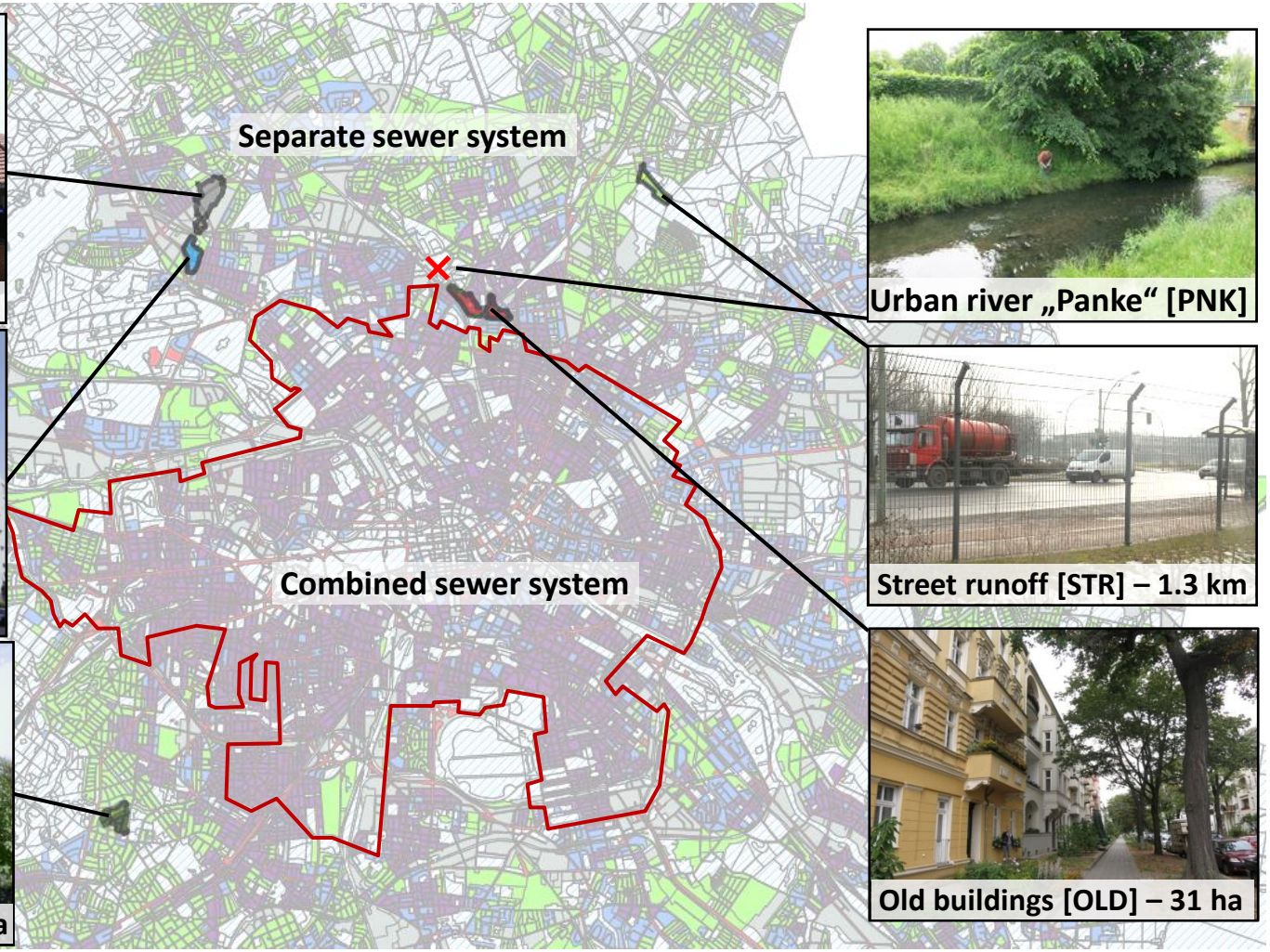


Monitoring Catchments

Commercial area [COM] – 36 ha

New buildings [NEW] – 17 ha

One family homes [OFH] – 16 ha



Urban river „Panke“ [PNK]

Street runoff [STR] – 1.3 km

Old buildings [OLD] – 31 ha

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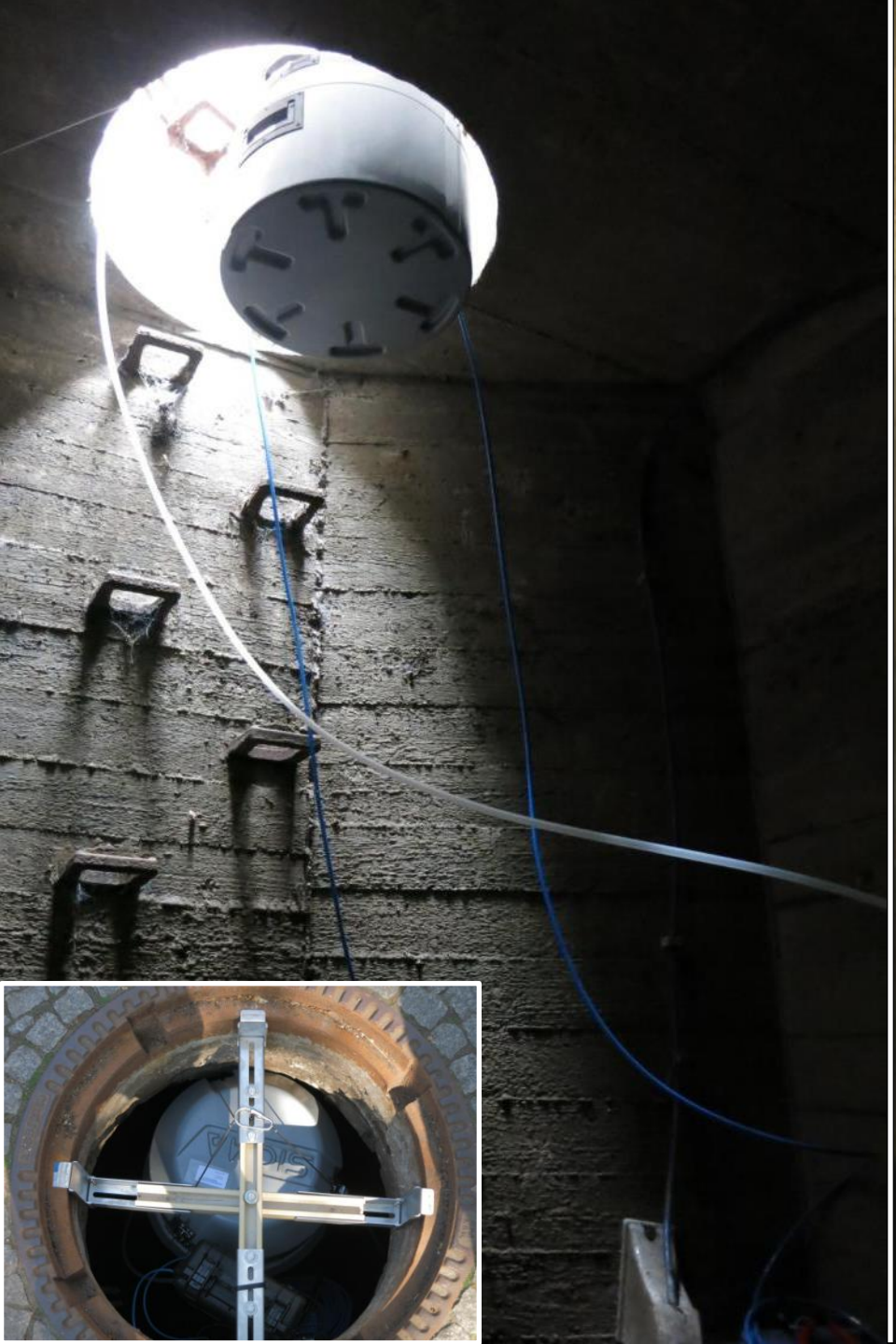
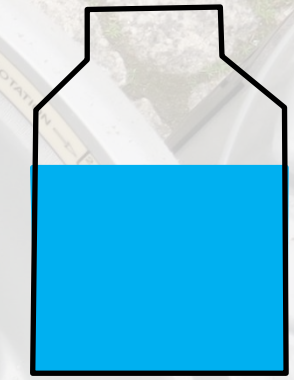
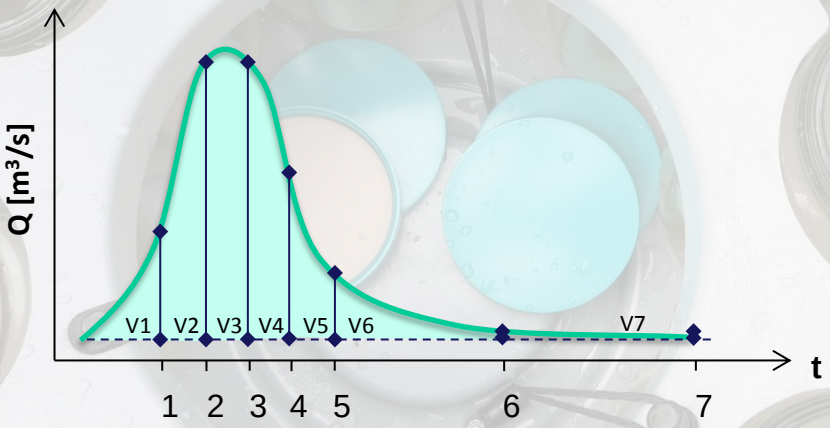


4 cm

How to get event mean concentrations?



5 L composite sample (volume event mean conc.)



Chemical analysis

Bottle configuration	8 x 2L Glass bottles
Max. sampling duration	4 hours
Sampling strategy	V – proportional with manual mixing

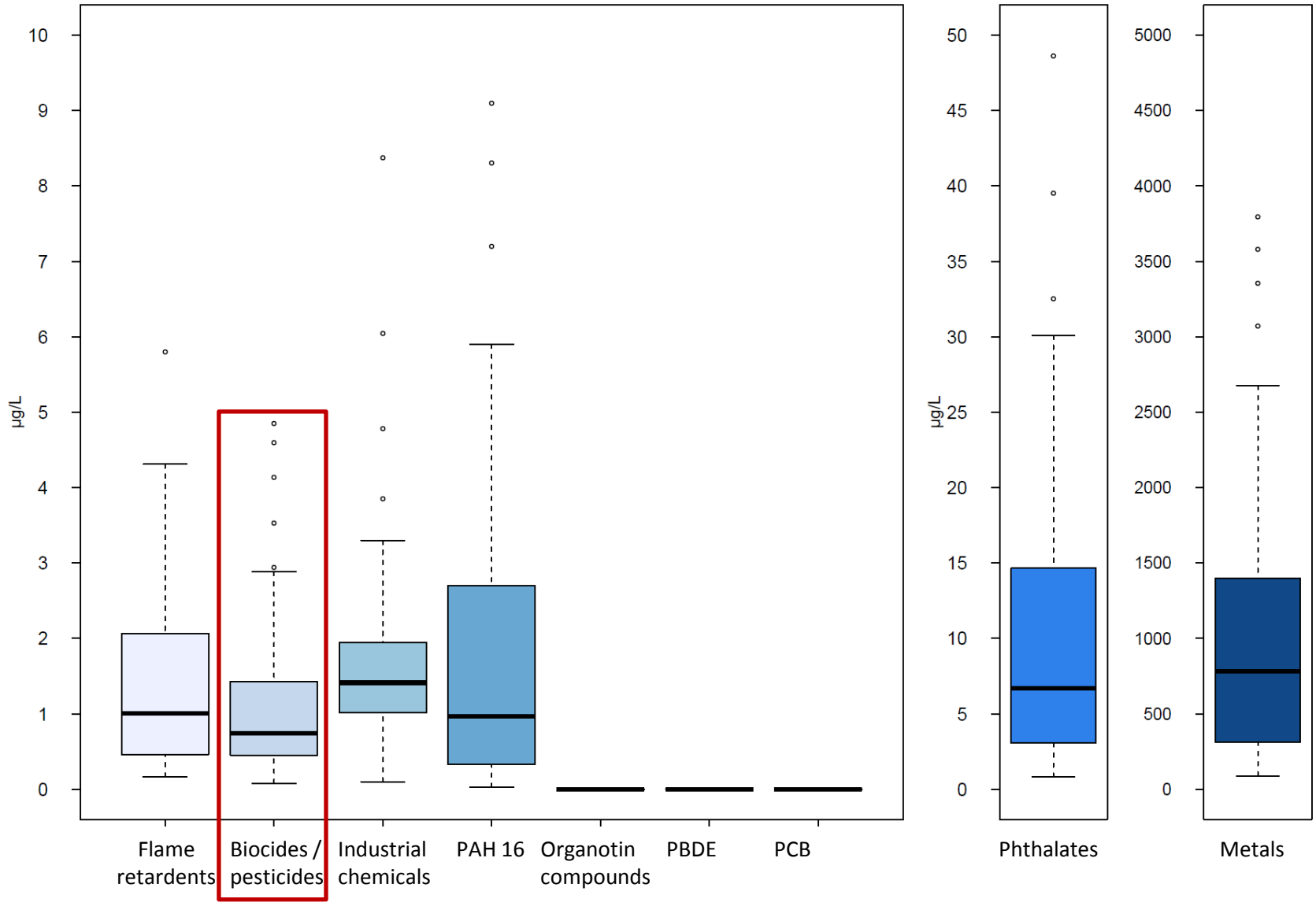
Micropollutant groups

Group (# micropollutants)	Typical compound	Examples of applications
Phthalates (8)	DEHP	Plasticizer (e.g. in PVC)
Organophosphates (6)	TCEP, TCPP	Flame retardants
Biocides / Pesticide (15)	Mecoprop, Diuron, Glyphosate, Terbutryn	House paints, herbicide control in gardens and foot paths, wall preservatives
Industrial chemicals Benzothiazoles (4) Benzotriazoles (3) Perflourated Tensides (2) Alkylphenols (4) Others (4)	 Benzothiazole Benzotriazole PFOS Nonylphenol MTBE, Bisphenol A	 Vulcanization accelerator (tyres) Corrosion inhibitors, lubricant (engines) Coatings Synthetics, tyre wear
PAH (16)	Benzo[a]pyrene	From combusion processes, tyre wear
Organotin compounds (4)	Tributyltin	Wood preservatives, Antifouling
PCB (7)		Plasticizer in coating materials, sealings and synthetics
Polybrominated diphenyl ethers (PBDE) (9)		Flame retardants
Heavy metals (10)	Copper, zinc, titanium	Brake wear, Tyre wear, building materials
Others	Nicotin	From cigarette butts

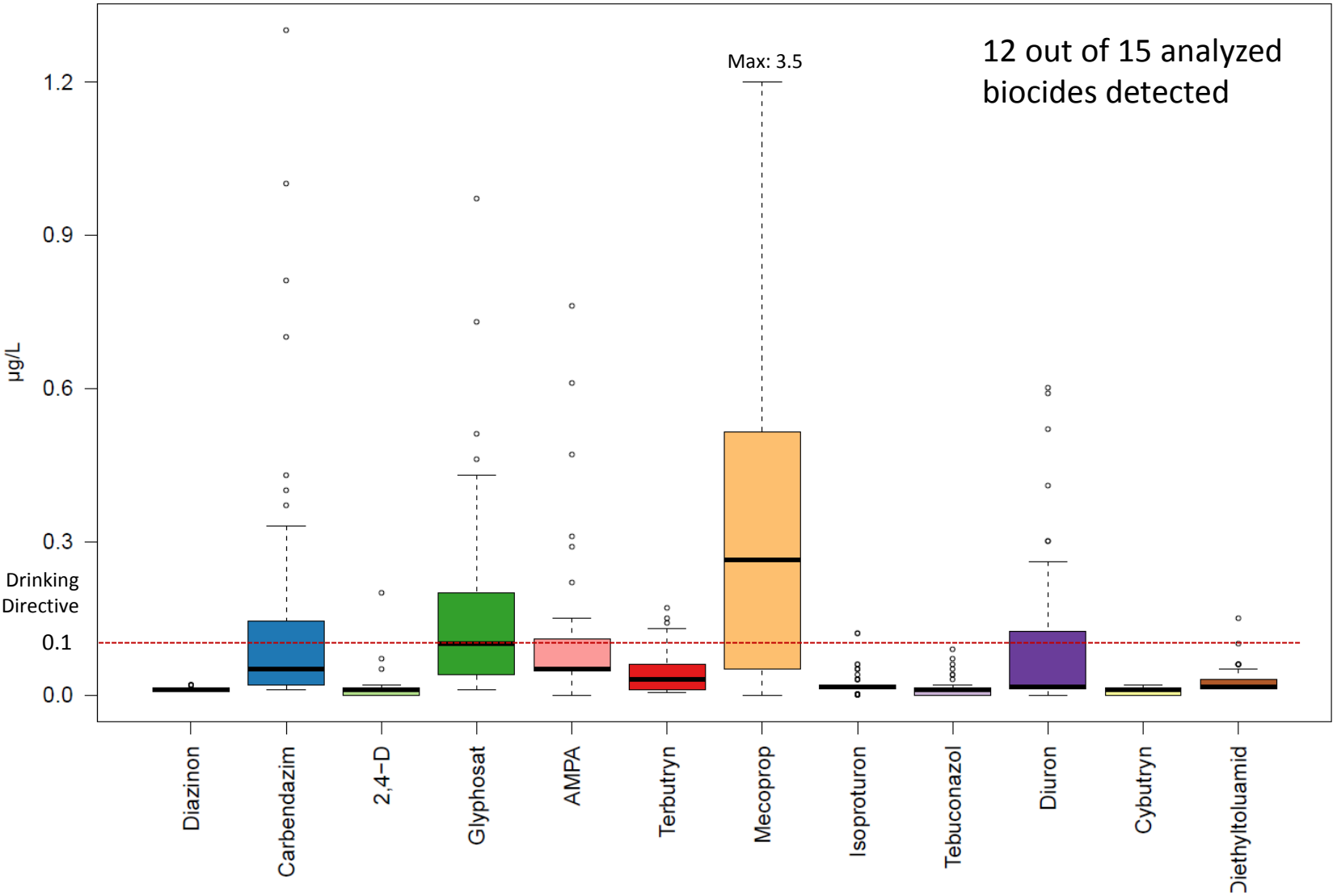
Results

- 10 to 17 events per site (total 70) sampled and analysed for micropollutants
- 65 of 95 analyzed substances detected

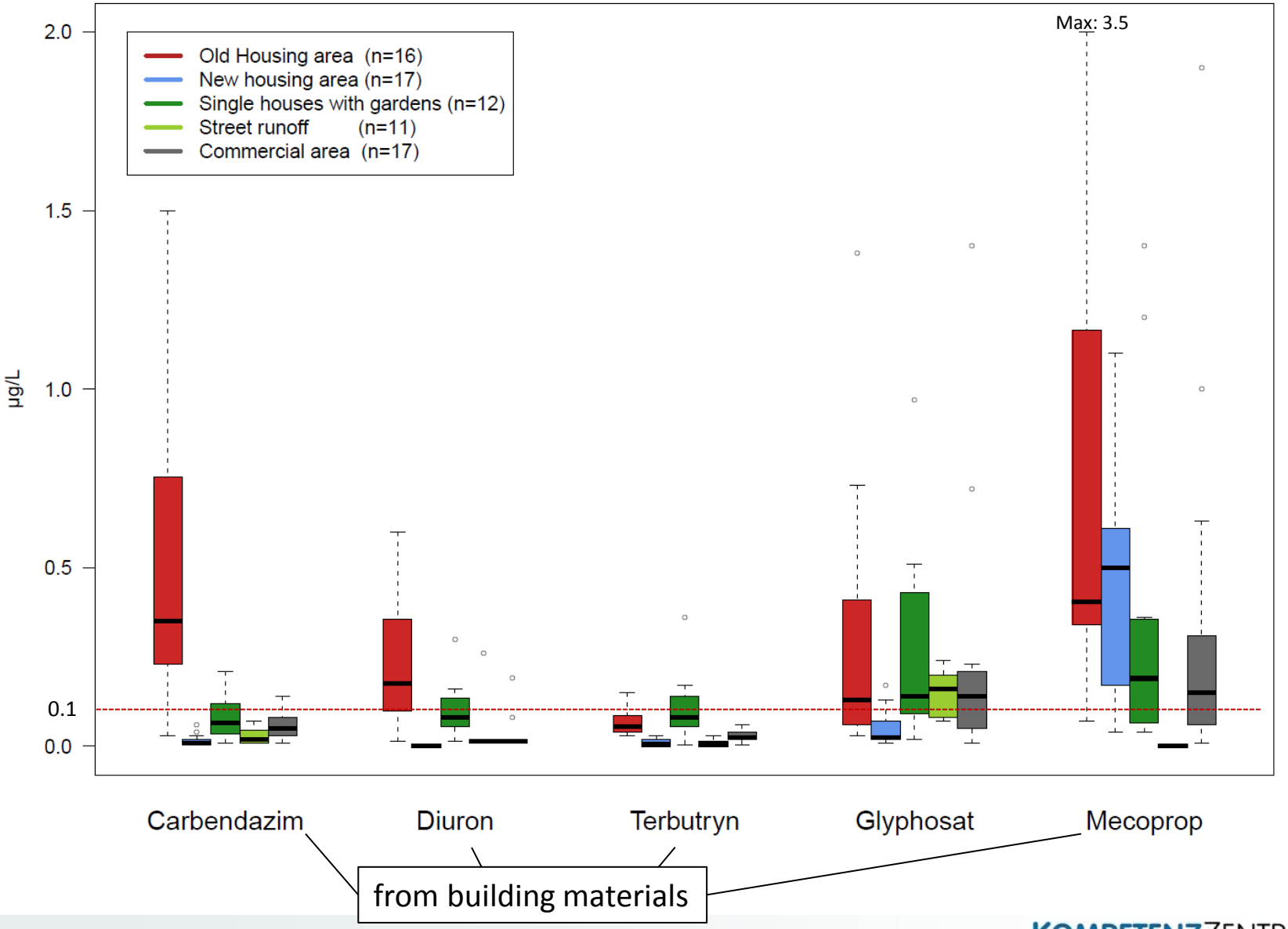
Overview pollutant groups



Biocides – all catchments

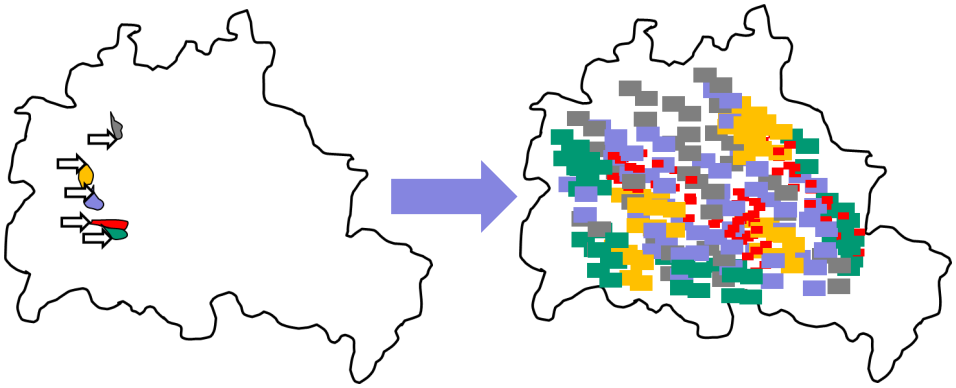


Biocides: catchment-specific differences

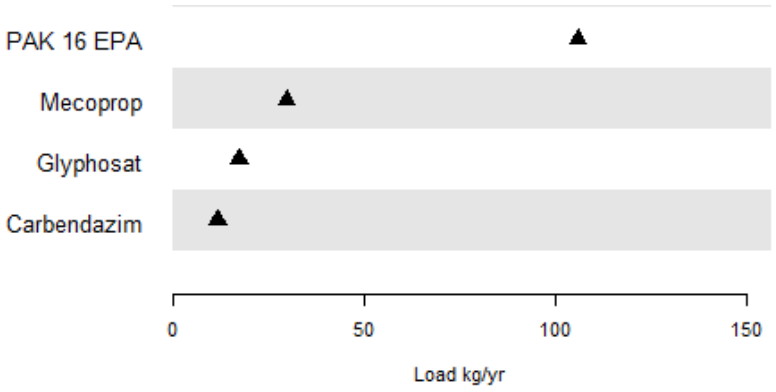


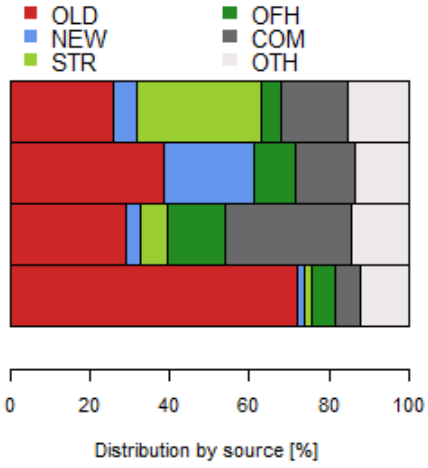
Estimation of annual city-wide loads

- Stormwater **runoff** calculations based on ABIMO
- Load calculation:
  - First Approach: mean concentrations by catchment
  - Second approach: Correlation with external parameters (rain, climate)

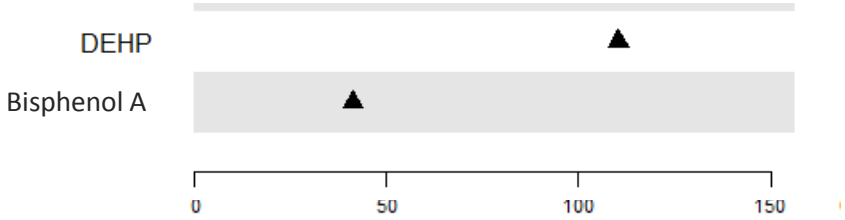


Rain





WWTP



→ Similar loads of micropollutants in rain runoff compared to WWTP effluent

Biocides in urban river

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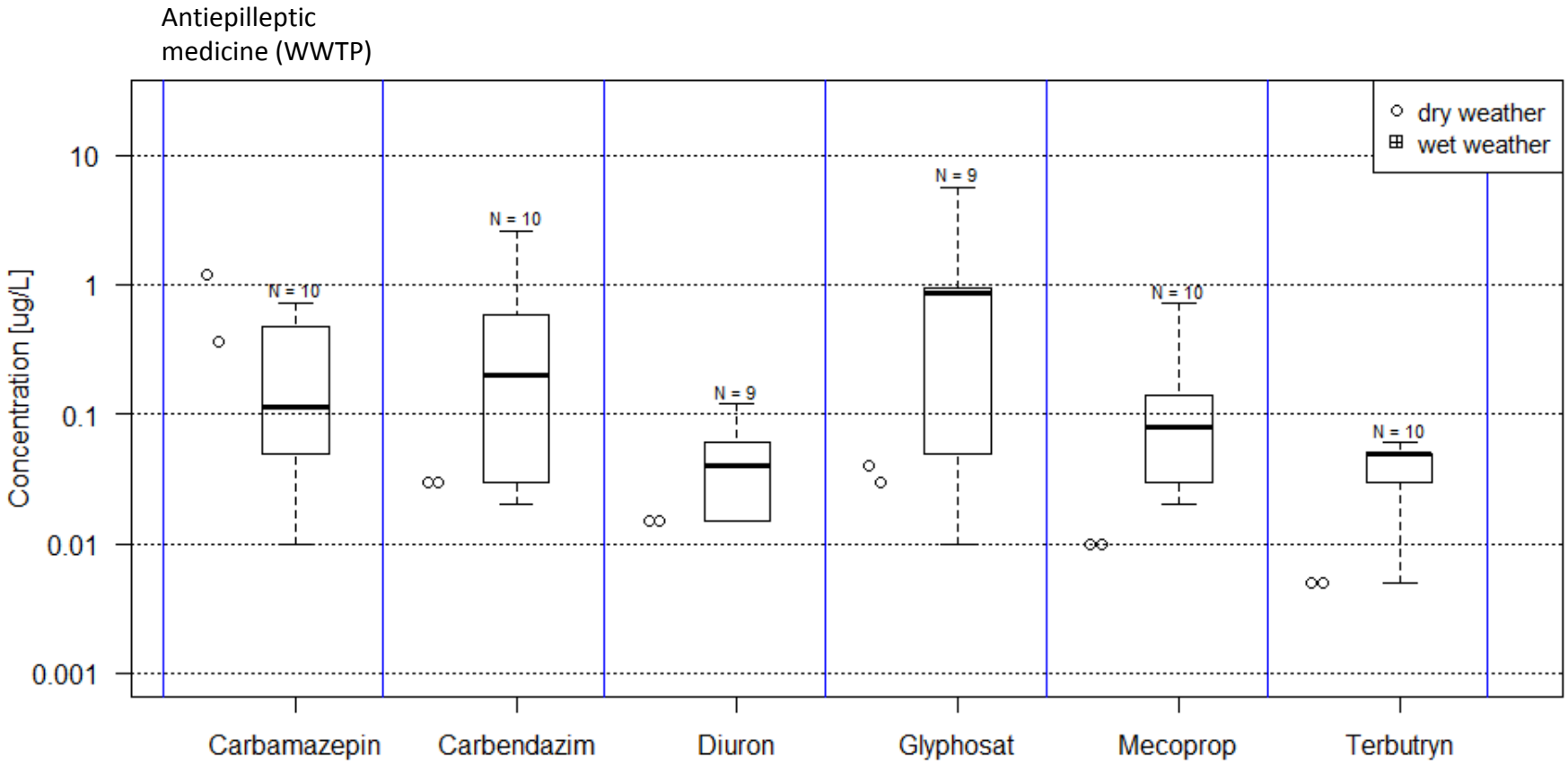
Biocides in urban river

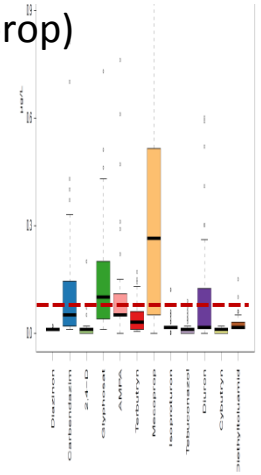


- Wet weather concentrations of biocides up to 25-fold higher (glyphosate) than dry weather flow

  → Stormwater runoff as source of biocides in urban river (in contrast to pharmaceuticals)

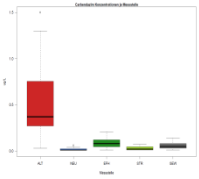
Some take home messages

- Biocides detected in urban stormwater at concentrations up to 3.5 µg/L (mecoprop)

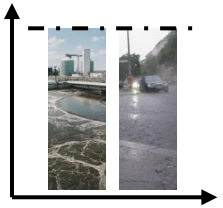


- Biocides relevant in regard to guideline values:
  - Mecoprop: bituminous layers
  - Carbendazim: preservation of building materials (paint, sealants)
  - Diuron: exterior paints
  - Terbutryn: exterior paints
  - Glyphosate/AMPA: herbicide application (gardens, food paths)

- Catchment-specific results
  - OLD: Carbendazim, Diuron
  - OFH: Terbutryn, Glyphosate



- Biocides in urban river due to discharge of stormwater runoff



- Estimated city-wide loads of biocides in rain runoff for Berlin up to 30 kg/yr (comparable to pharmaceutical loads from WWTP)

→ Results suggest that urban stormwater runoff is relevant source of selected biocides

Questions ?

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