



Combined sewer overflow quality and EU Water Framework Directive

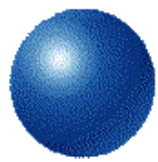
J Gasperi, M Cladière, V Rocher and R Moilleron



*Observatory of Urban
Pollutants in Paris (France)*



*The Future of Urban Water: Solutions for Liveable and Resilient Cities
SWITCH Scientific Meeting, France, 2011 January*



Environmental topic

- European Water Framework Directive 2000/60/EC
- WFD + daughter Directives → 41 Priority Pollutants (PPs)
- **Environmental Quality Standards** → to achieve “good ecological and chemical surface water status” in 2015
- **Combined sewer overflows (CSOs)** → sources of PPs ???



Quality of CSOs ???
Occurrence of PPs
Conc of PPs



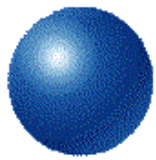
**Assessment of
PPs in CSOs**



**CSO contribution
to the urban
pollutant loads ??**

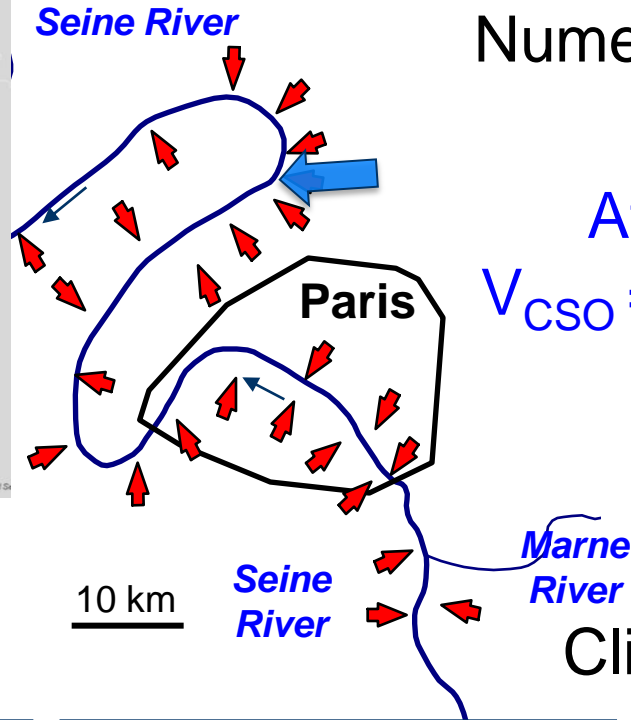
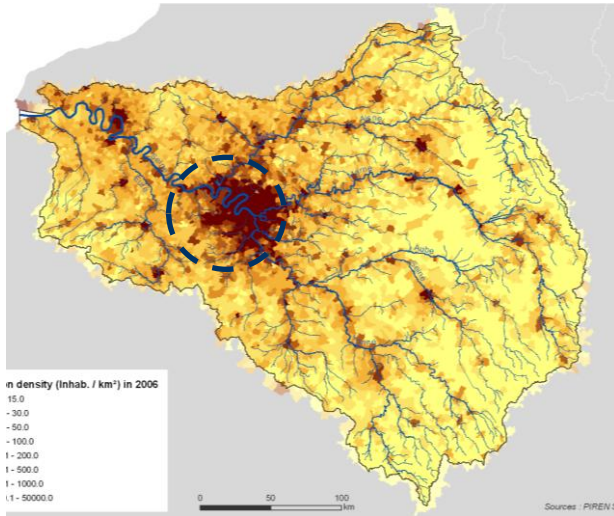


**CSO reduction and “good
water status” ?**



Site and sampling campaigns

The Seine river basin

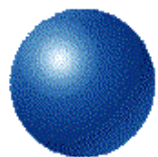


Paris : combined sewer network
Numerous CSO outfalls

At the scale of Paris
 $V_{CSO} = 50 - 100 \times 10^6 \text{ m}^3 \cdot \text{y}^{-1}$

Clichy CSO outfall

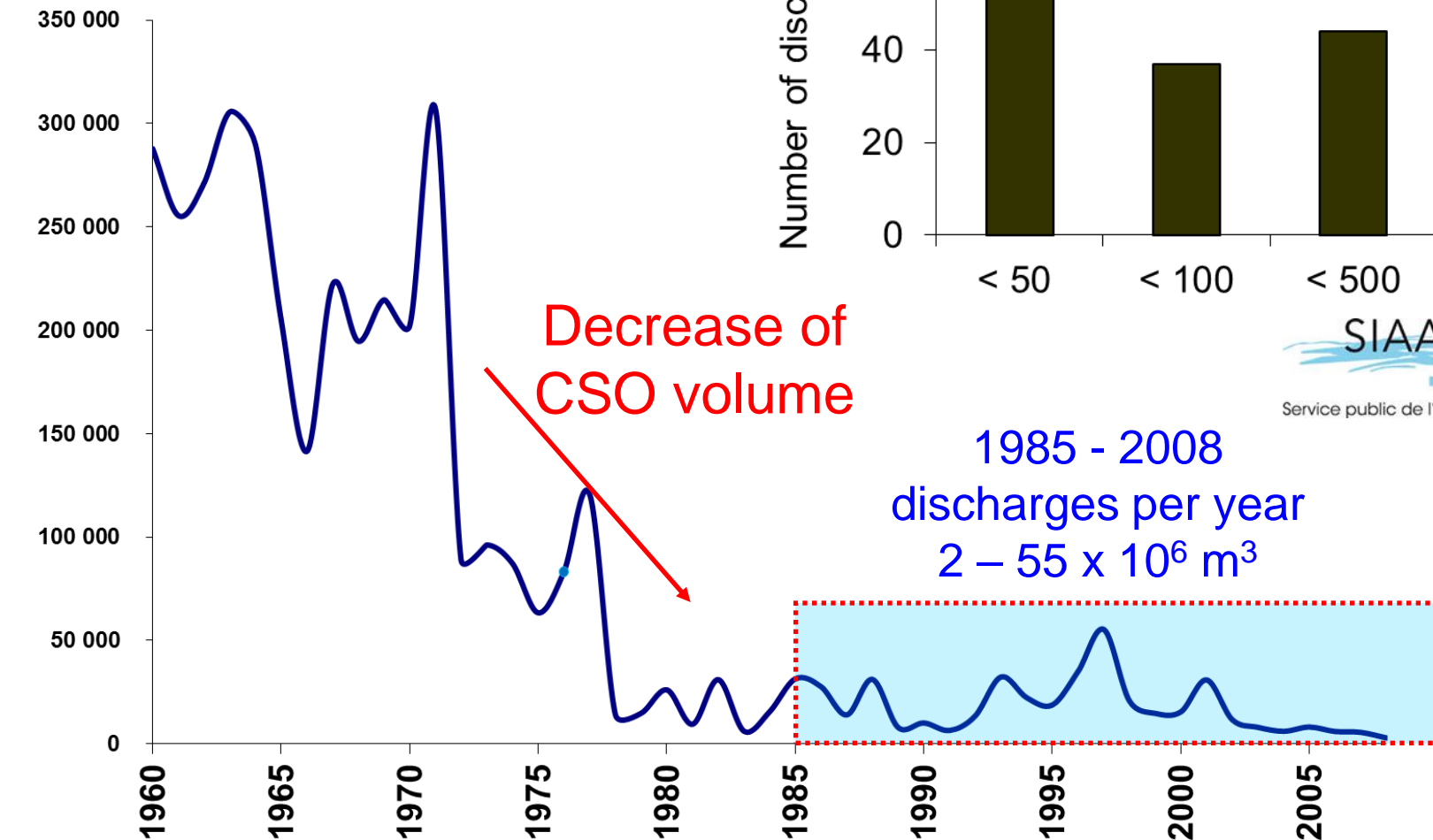




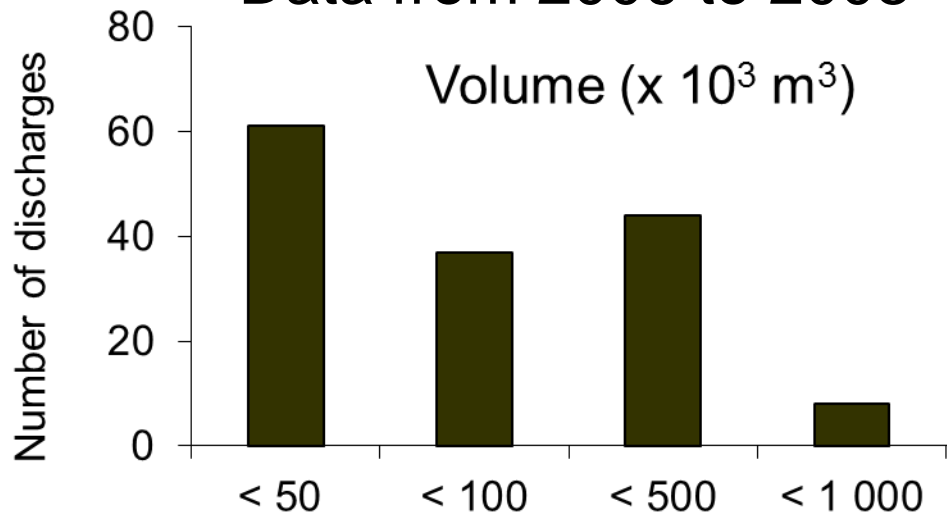
Site and sampling campaigns

➤ The Clichy CSO outfall

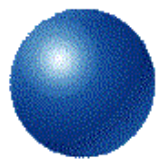
V_{CSO} ($\times 10^3 \text{ m}^3$)



Data from 2006 to 2008

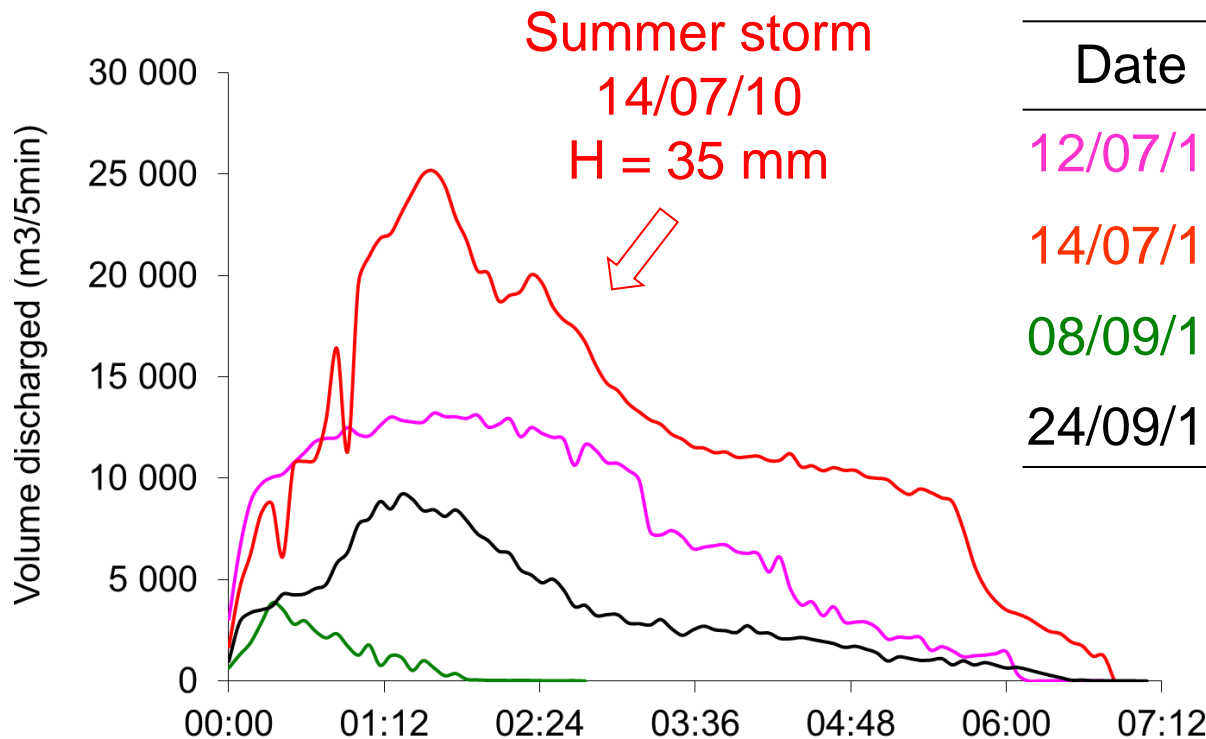


SIAAP
1970-2010 40ans
Service public de l'assainissement francilien

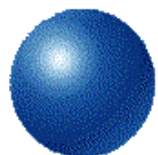


Site and sampling campaigns

- 2 automatic samplers respectively equipped for organic pollutants and metals
- 4 rain events sampled (From July to Sept.)



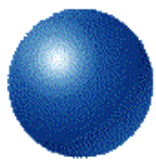
Date	Vol (10 ³ m ³)	Runoff (%)
12/07/10	426	77-87
14/07/10	1 000	86-95
08/09/10	38	68-77
24/09/10	279	74-89



Priority pollutants monitored

- 88 substances including 41 WFD PPs
- Analyses carried out by a Lab certified by Ministry of Envir.
- Analyses on **total** or dissolved and particulate phases

Famille	WFD	Additional Sub.	Total
Alkylphenols	2	3	5
BTEX	1	4	5
Chloroalkanes	1	-	1
Chlorobenzenes	3	2	5
Chlorophenols	1	1	2
VOC	4	3	7
PAH	8	8	16
Metals	4	4	8
Organotin	3	-	3
PBDE	1	2	3
PCB	-	8	8
Pesticides	12	12	24
Phtalates	1	-	1
Total	41	47	88



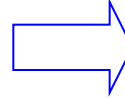
PP contamination of CSOs

CSOs (n = 4, 88 subst.)

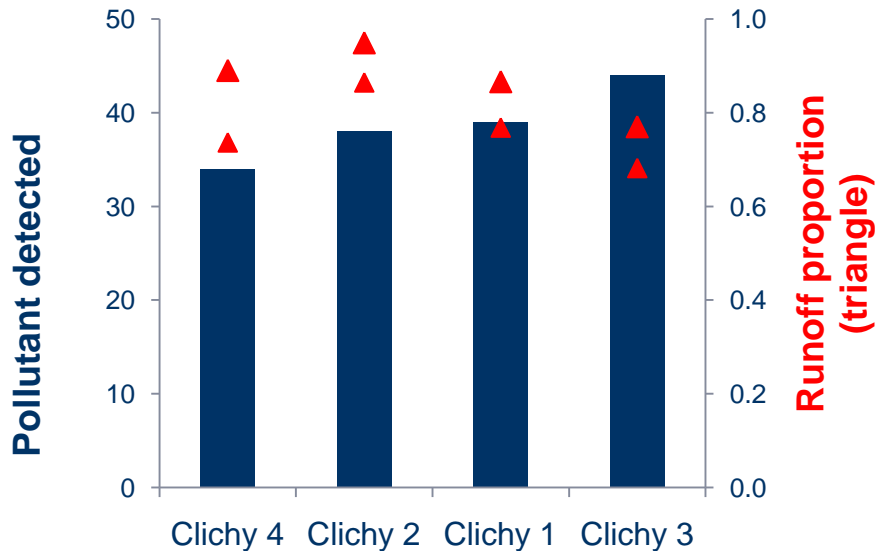
50 pollutants detected

22 PPs

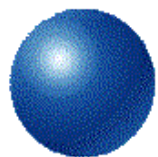
Including 11 PHS



- 5 Metals
- 16 PAHs
- 3 Alkylphenols
- 1 Phtalate
- 9 Pesticides
- 5 VOCs
- 6 PCBs
- 5 Others



Copper	DEHP
Mercury	Aldrine
Zinc	Dieldrine
Lead	Atrazine
Chrome	Desethylatrazine
Benzo(a)pyrene	Diuron
Benzo(b+k)fluor	Isoproturon
Benzo(ghi)perylene	Aminotriazole
Indeno(cd)pyrene	Glyphosate
Anthracene	AMPA
Naphthalene	Toluene
Fluoranthene	Ethylbenzene
Acenaphtylene	Tetrachloroethylene
Fluorene	Trichloroethylene
Phenanthrene	Xylenes
Pyrene	Nonylphenols
Benzo(a)anthr	Octylphenol
Chrysene	Butylphenol
Dibenzo(ah)anth	Organotins (3)
Acenaphtene	DecaBDE
6 PCBs	Chloroalkanes



PP contamination of CSOs

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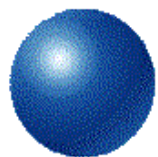
- | | |
|------------------|----------------|
| ■ 5 Metals | ■ 9 Pesticides |
| ■ 16 PAHs | ■ 5 VOCs |
| ■ 3 Alkylphenols | ■ 6 PCBs |
| ■ 1 Phtalate | ■ 5 Others |



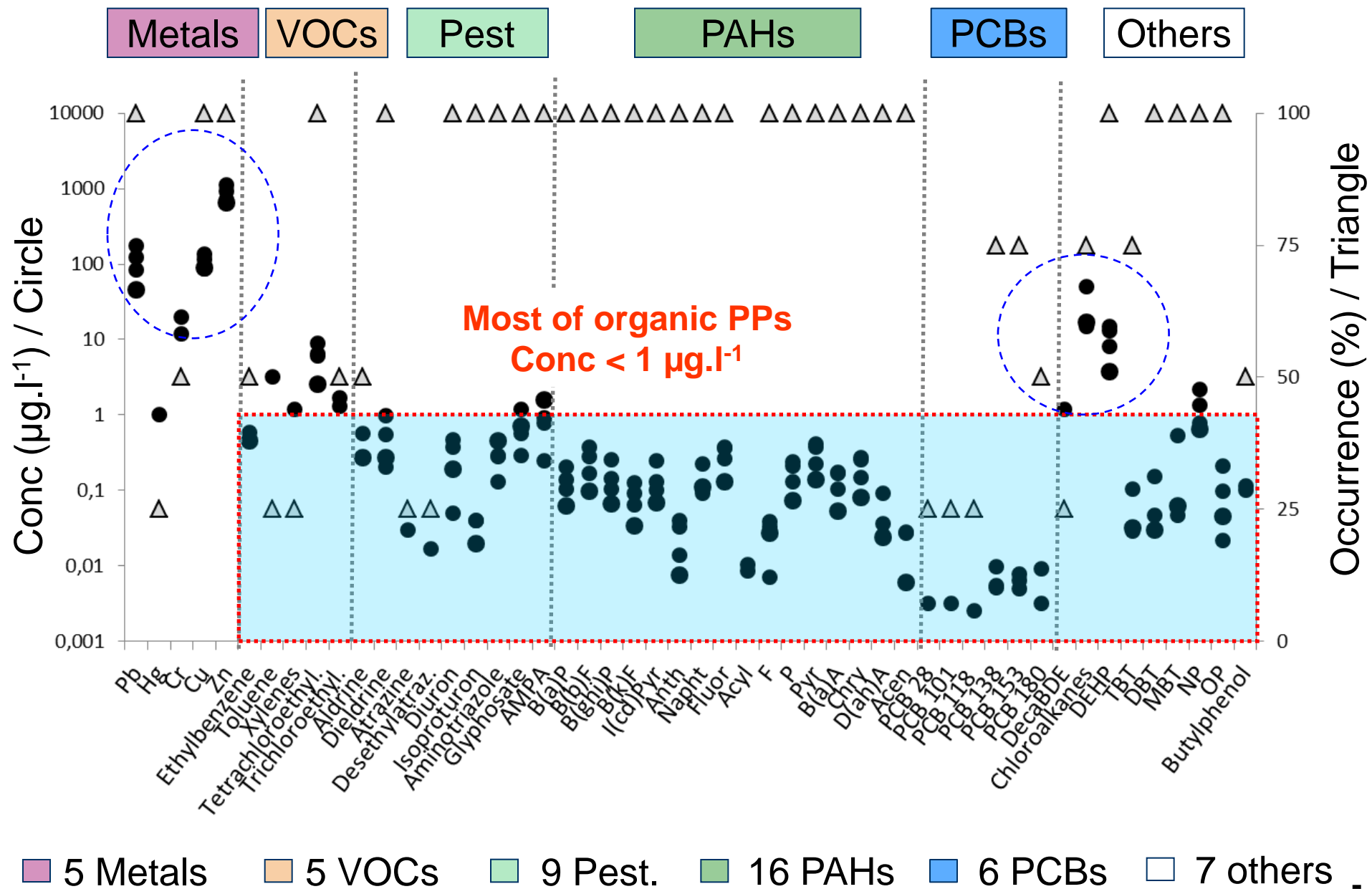
Concentrations below LOQ

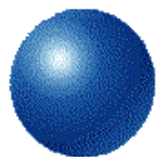
Low-level metals (Ni and Cd)
Chlorobenzenes ($< 0.03 \mu\text{g.l}^{-1}$)
Penta & octa-BDE ($< 0.03 \mu\text{g.l}^{-1}$)
Banned pesticides ($< 0.03 \mu\text{g.l}^{-1}$)
(HCH, triazines, lindane, etc.)

Copper	DEHP
Mercury	Aldrine
Zinc	Dieldrine
Lead	Atrazine
Chrome	Desethylatrazine
Benzo(a)pyrene	Diuron
Benzo(b+k)fluor	Isoproturon
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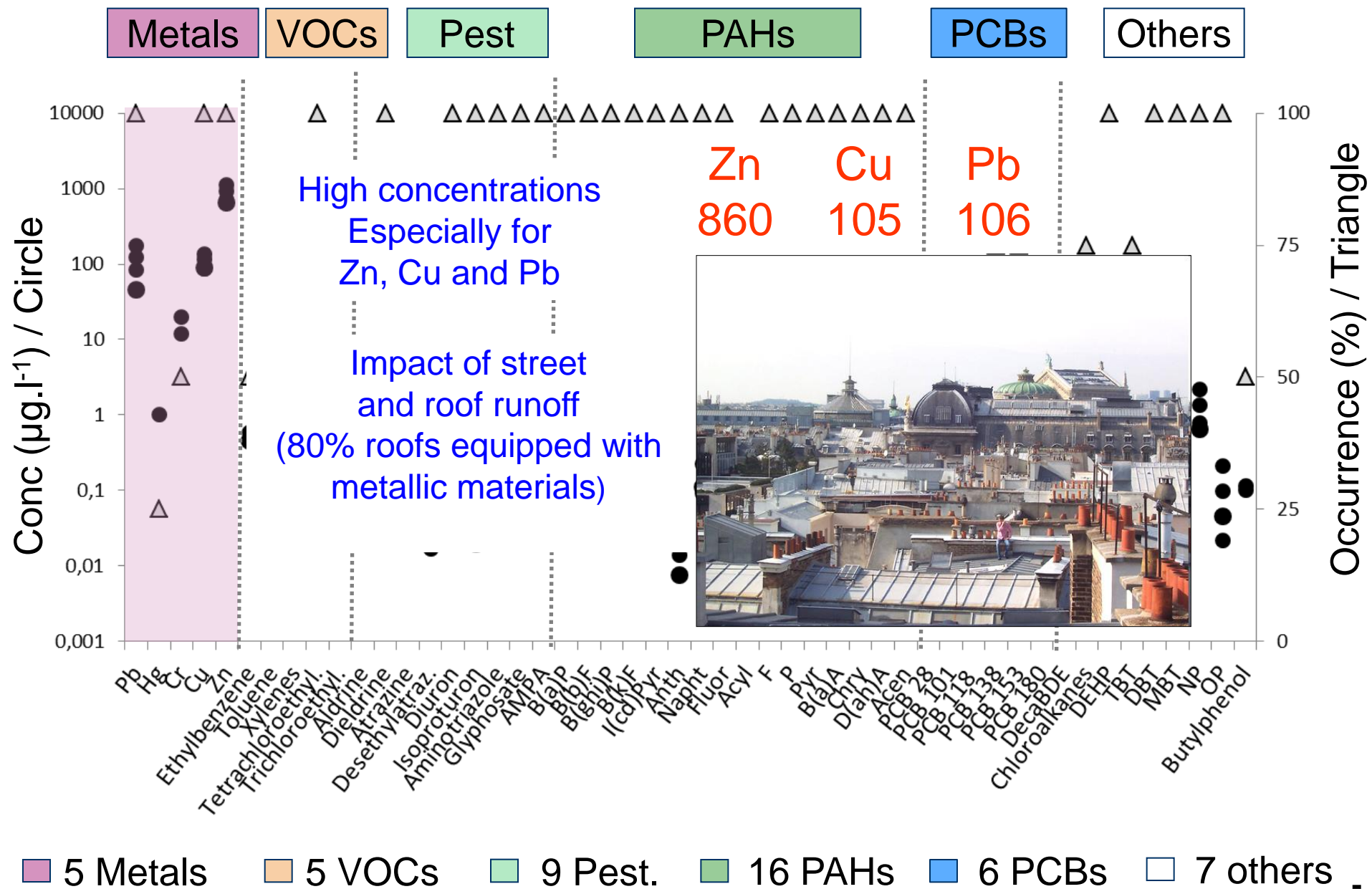


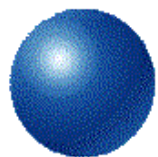
PP contamination of CSOs



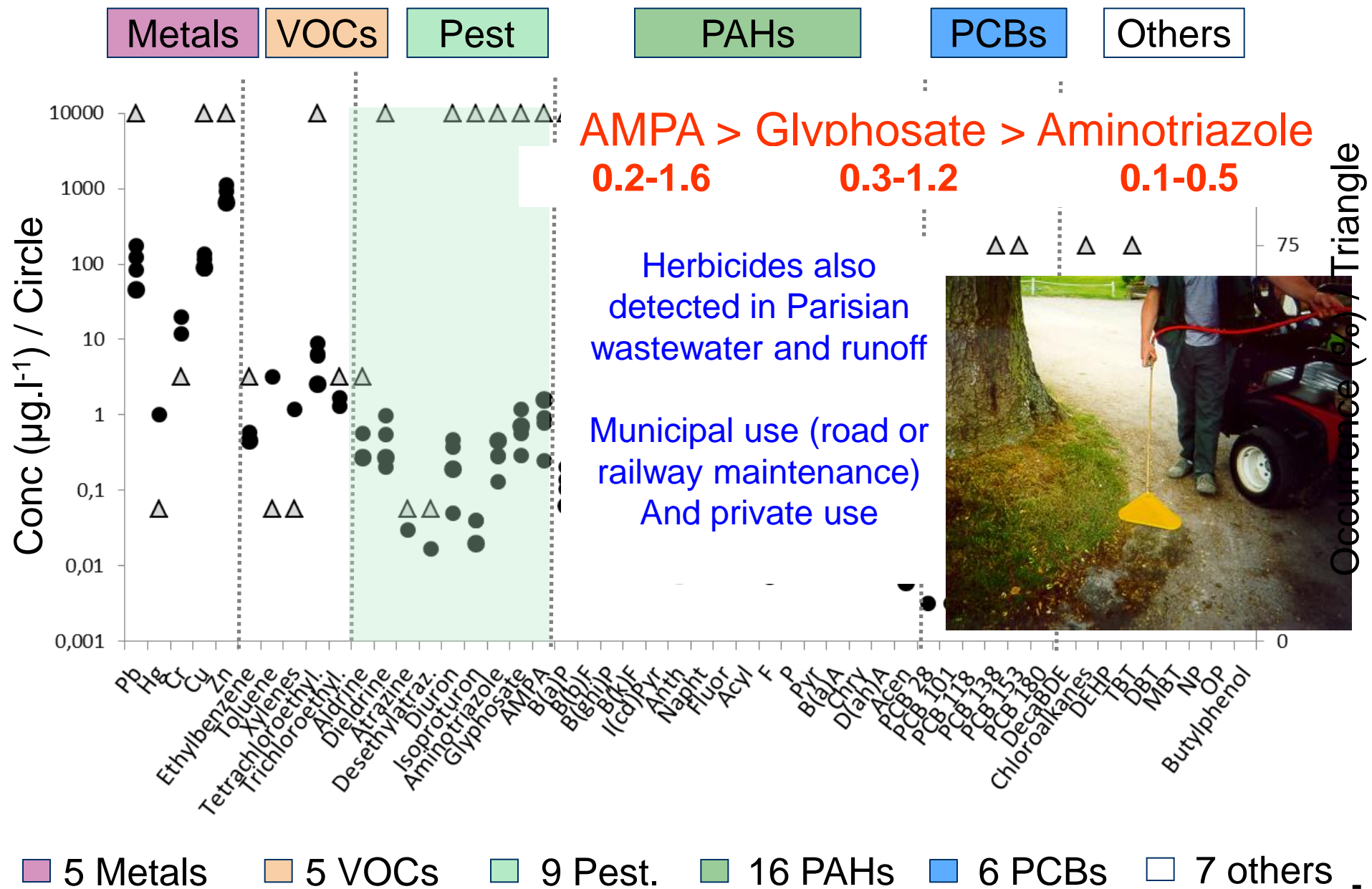


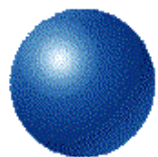
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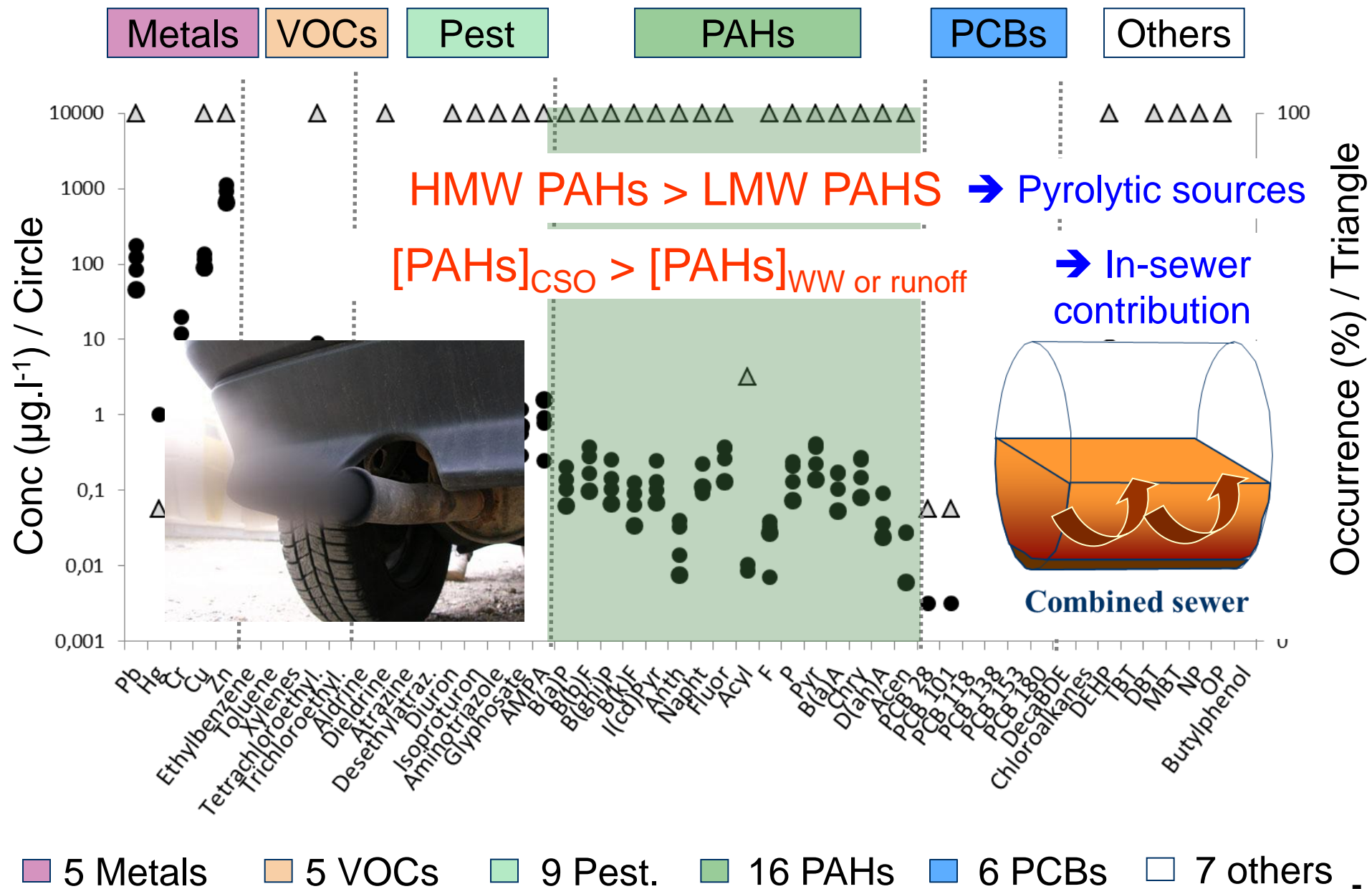


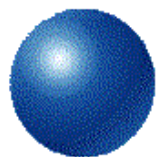
PP contamination of CSOs



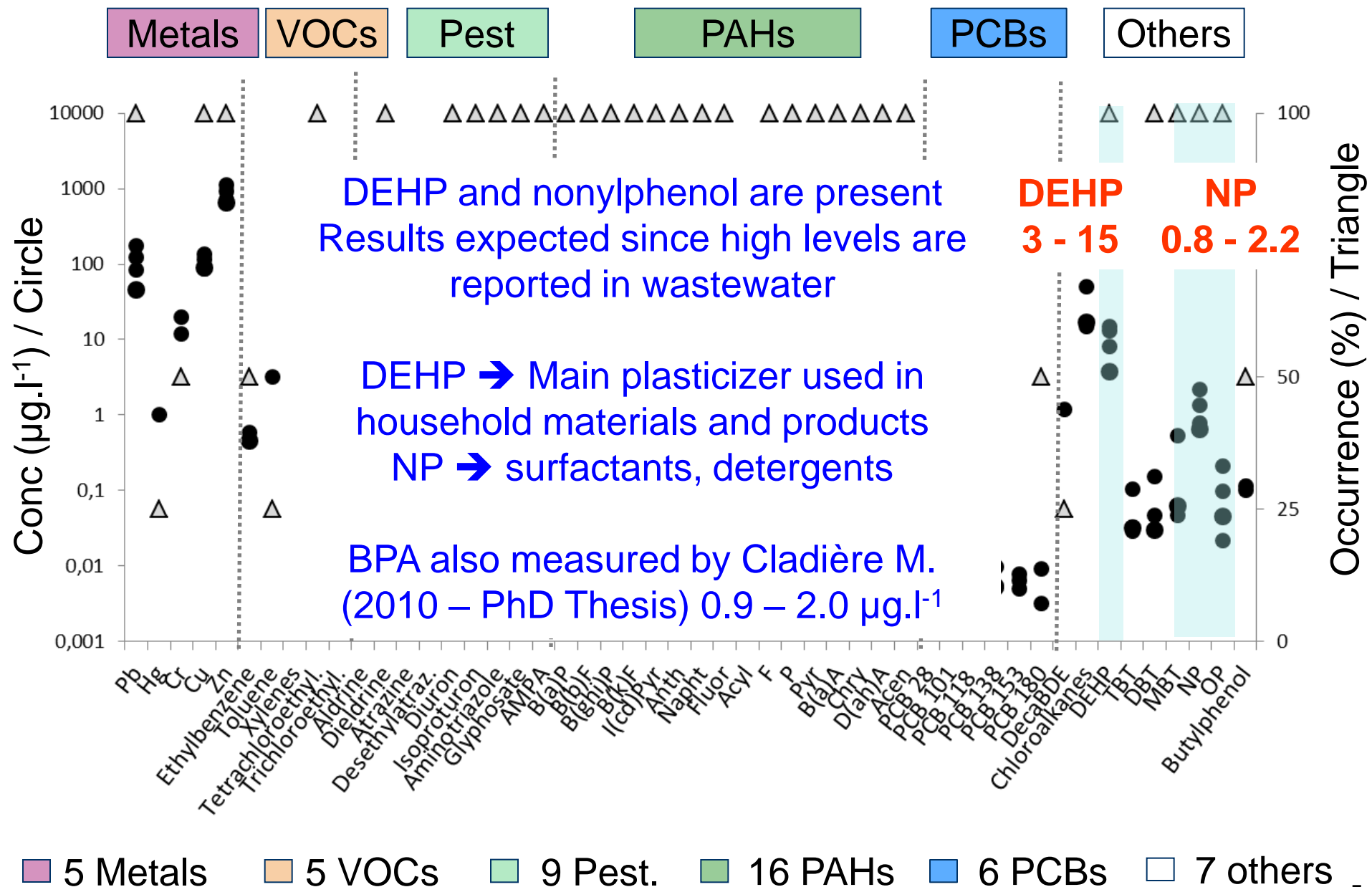


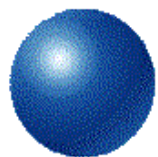
PP contamination of CSOs



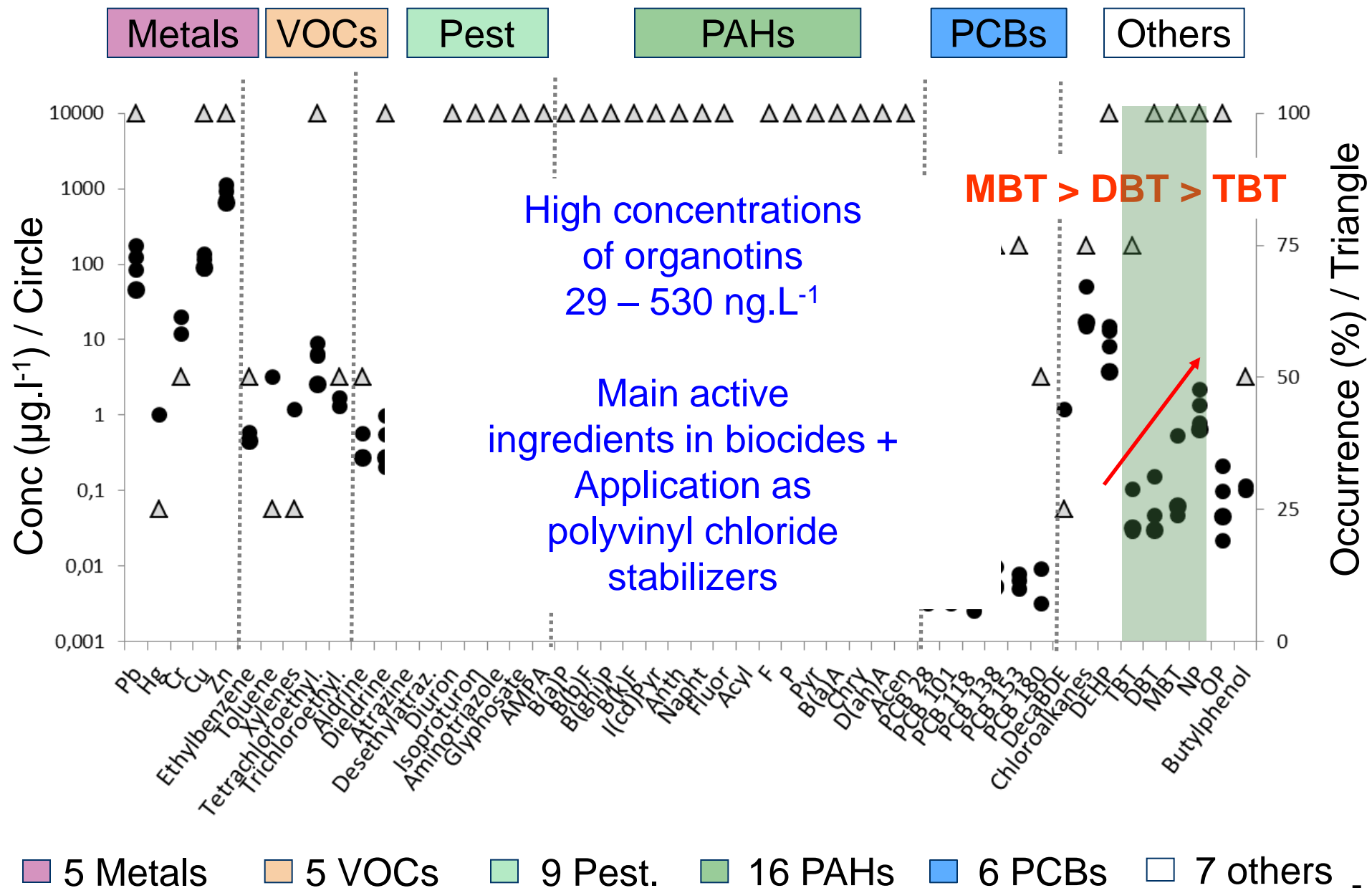


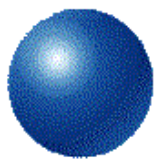
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PP contamination of CSOs

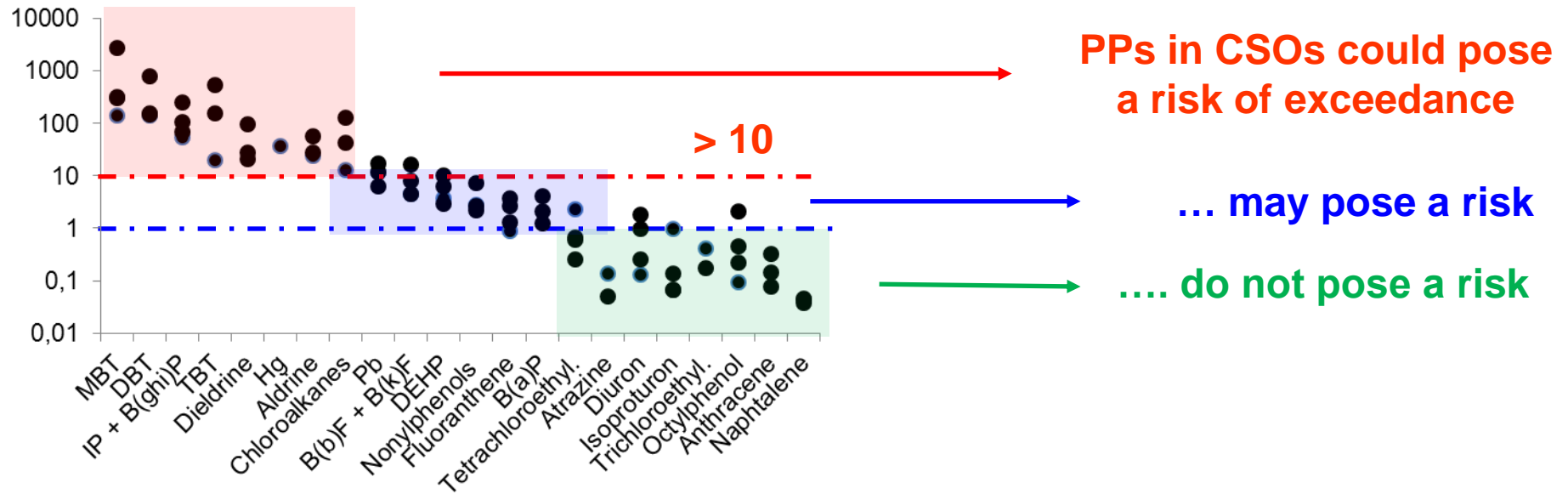




CSO concentrations and EQS

Average annual
concentration
CSO/AAC-EQS

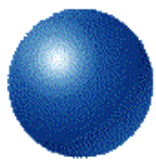
Maximal allowable
concentration
CSO/MAC-EQS



> 10
Tributyltin
PAHs
Chloroalk.
Pb & Hg

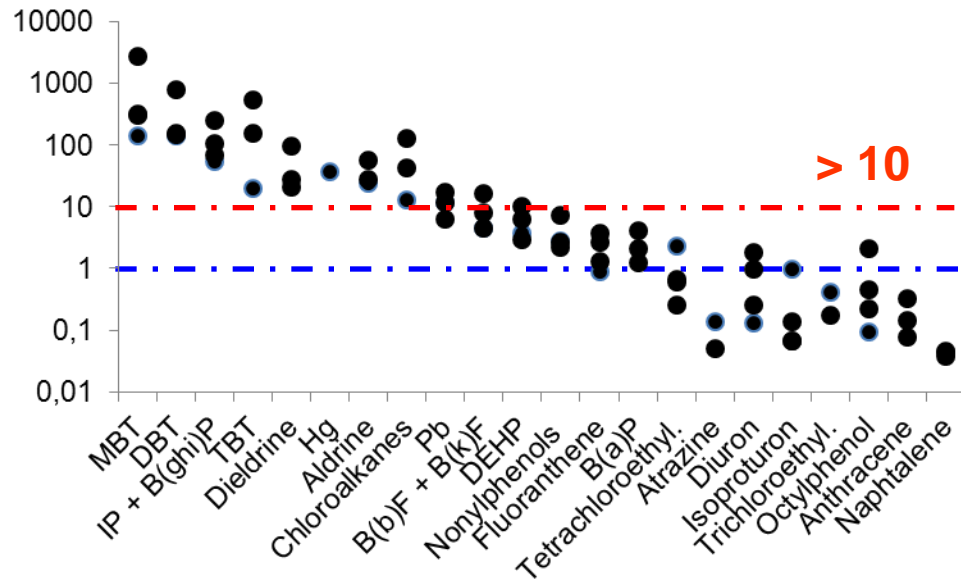
> 1
DEHP
Nonylphenol
Fluo, B(a)P

< 1
Atrazine,
diuron
isoproturon
Anth, Napht

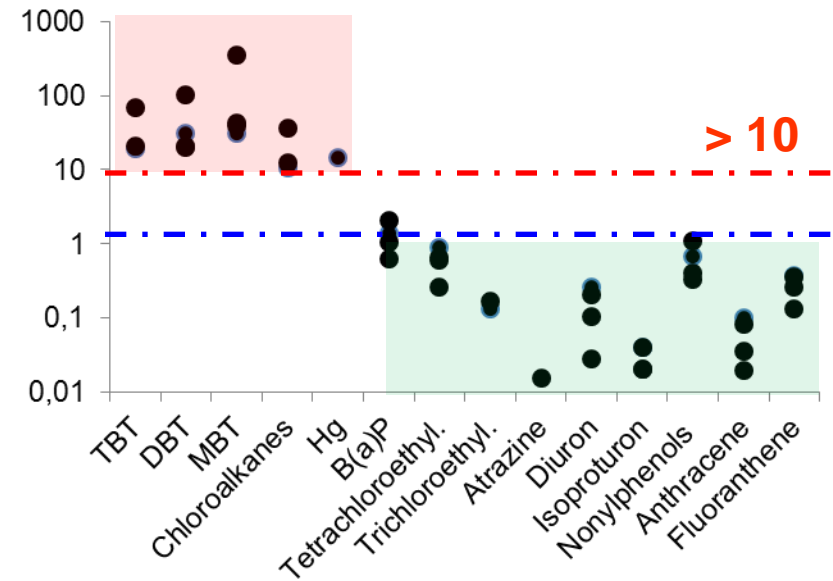


CSO concentrations and EQS

Average annual
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Maximal allowable
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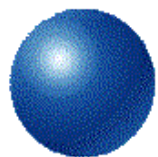
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Tributyltin
Chloroalk.
Hg

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PAHs
diuron



Conclusions

➤ Large broad of PP detected in CSOs

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50 pollutants detected

22 PPs

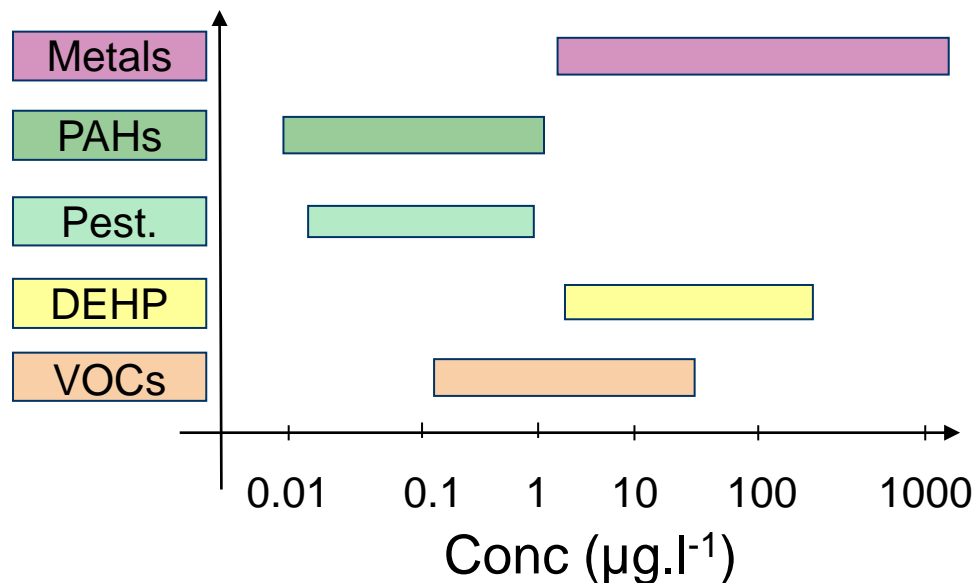
Including 11 PHS



Parabens / Triclosan (PhD Geara)

Nonyphenol / BPA (PhD Cladière)

Organic matter / metals (PhD Matar)

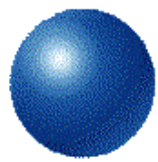


➤ CSO and EU WFD

- Concentrations > MAC-EQS for organotins, PAHs
- For the first time, chloroalkanes reported at high levels

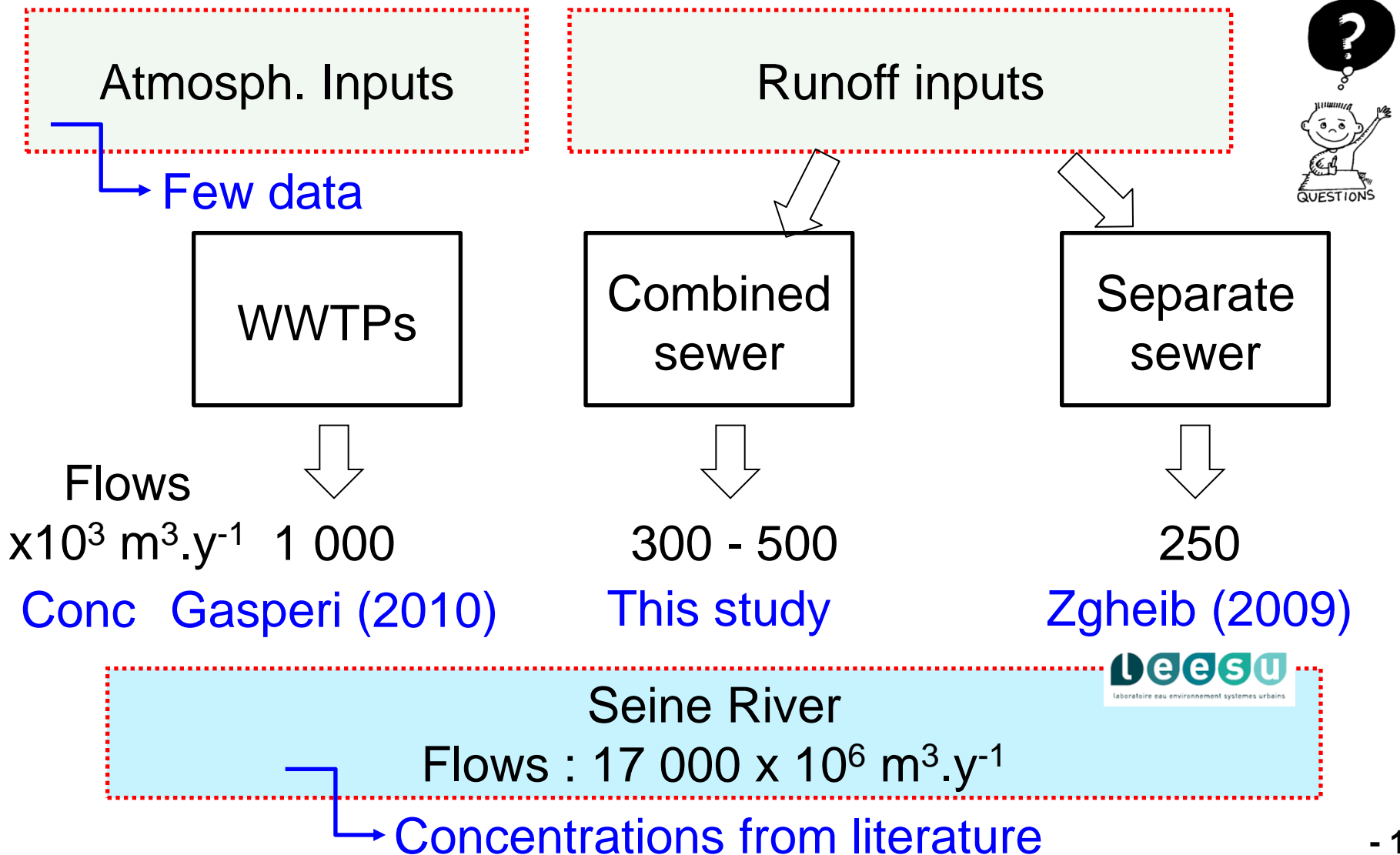
What role can be played by the CSO reduction to achieve the “good water status” ?

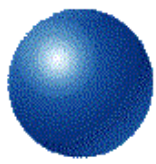




CSOs and WFD ???

- What role can be played by the CSO reduction to achieve “good water status”?





Thank you for your attention



<http://anthony.atkielski.pagesperso-orange.fr/SeineNightLarge.jpg>