Comparison of tools and protocols for groundwater sampling
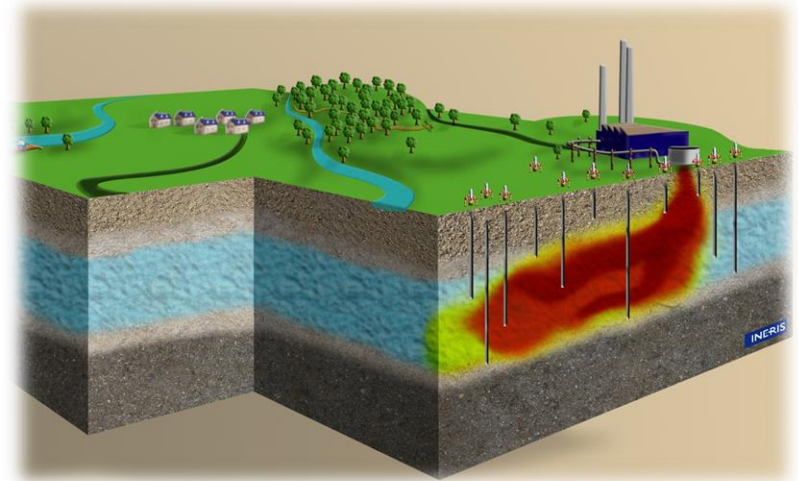
Fabrice Quiot, **INERIS**

Nicolas Diard, ERG Environnement

Mélody Mariot, EUROFINS

Groundwater monitoring and sampling

- In the **frame of polluted sites**:
- – industrial sites
- – mining sites

Monitoring <u>to prevent</u> &

Monitoring <u>to treat</u>

Sampling leads to determine the water quality and in case of break down, to understand origin and evolution. Data must be reliable, the **representativeness** of a groundwater sample is essential

Why a comparison ?

- Consultants lack of case study to clarify **choices** on tools and protocols relevant to the situation and the sampling aim, goal

Peristaltic pump

PDB

Discrete interval sampler

→ **test to give trends and recommendations or illustration on the influence of a change on concentrations results (on the basis of tests reproduced several times, different scales)**

Comparison

- Work started in 2014... end 2017 !

trace metals
hydrocarbons
volatile organic
compounds

collection of a large amount
of data

With use of
tracers: Cl,
Benzene,
Naphthalene...

different scales

No specific
piezometers

real conditions on sites

Not analysed by
research
laboratories

# Real scale and metric scale: experimental tank (INERIS, Aix-en-Provence)
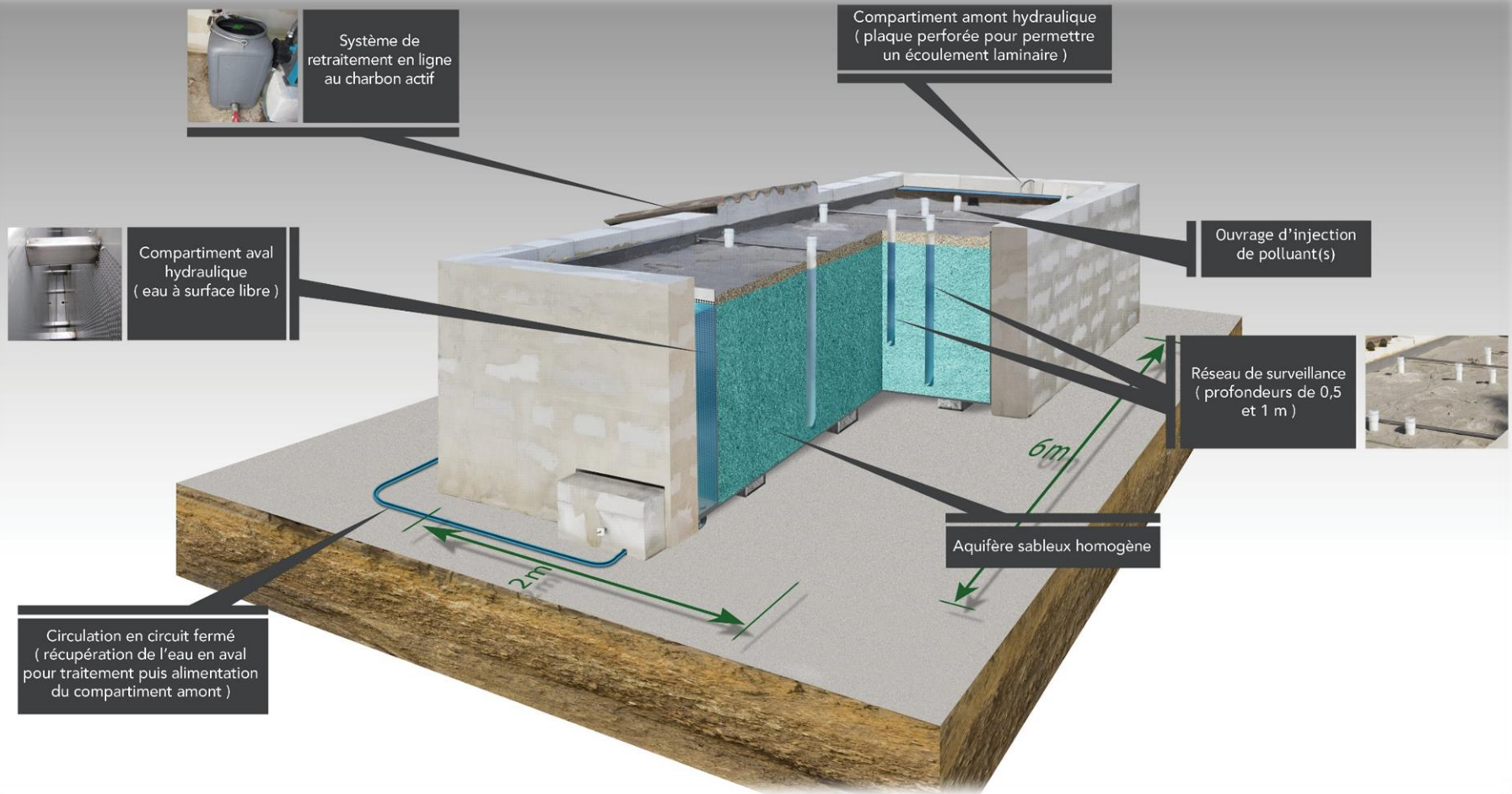
# Work related to several questions still relevant

- Use passive or active sampling technique ?
- Use multi-level sampling ?
- Loss of Volatile Organic Compounds ?
- Influence of vertical flows in wells ?
- Influence of purge ?
- Influence of filtration, decantation ?
- …

Examples of current results

Shallow sampling

Intermediate

Deep
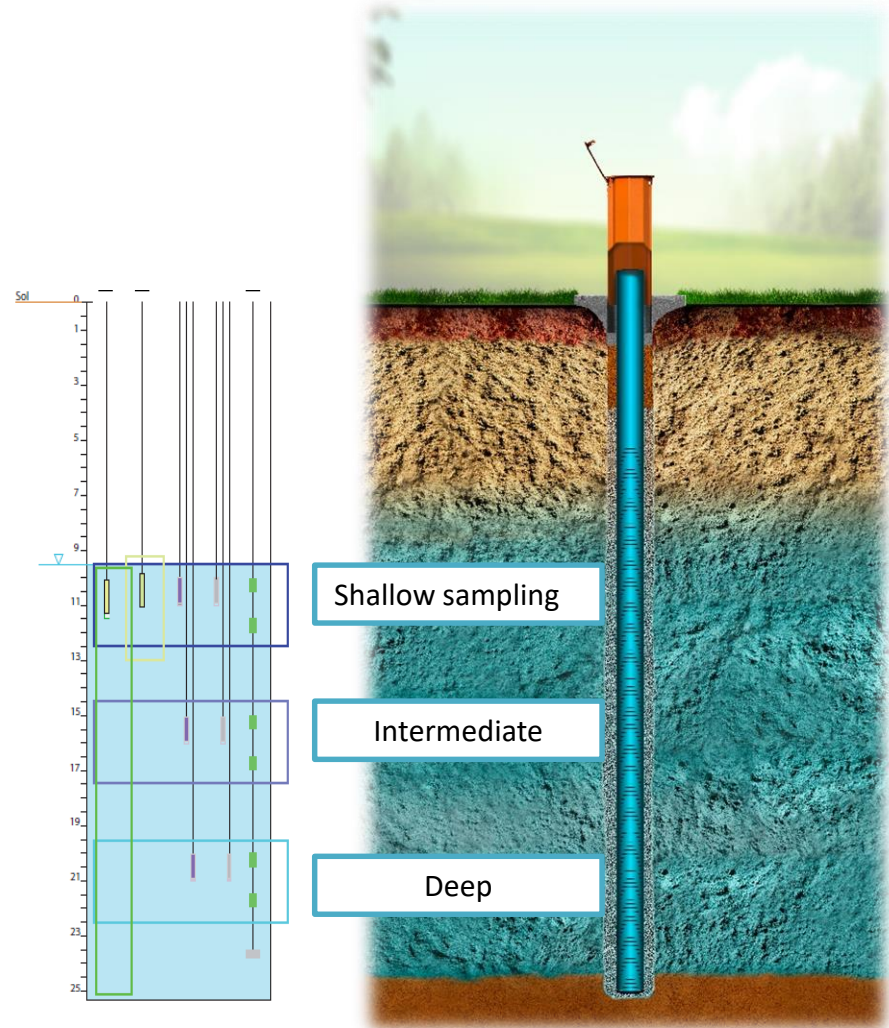
Preliminary Results – Loss of Volatile Organic Compounds (site)
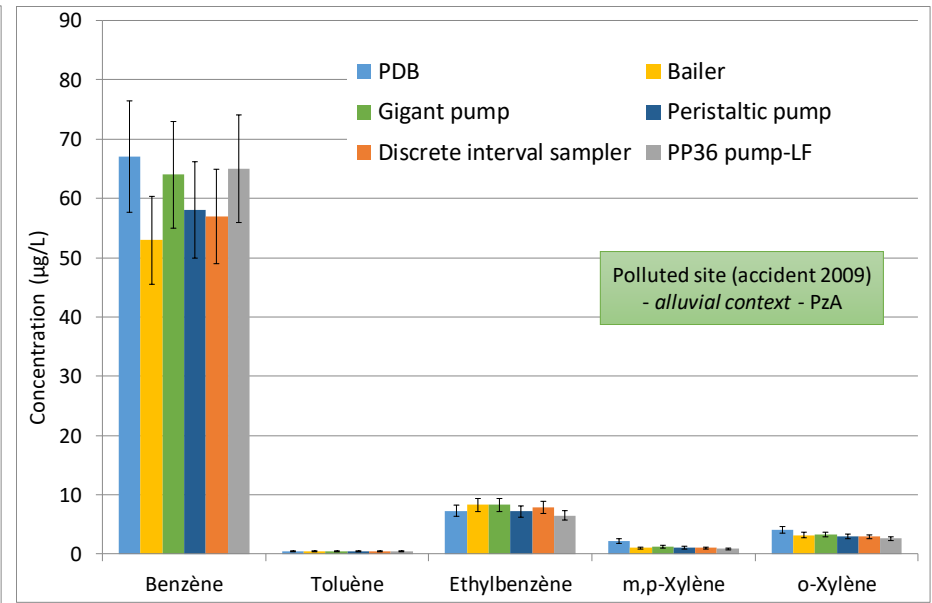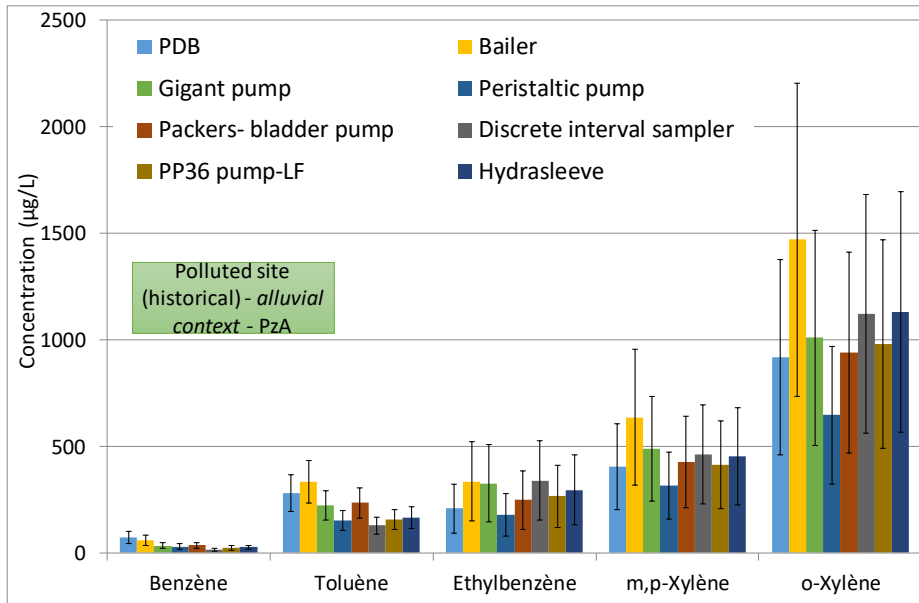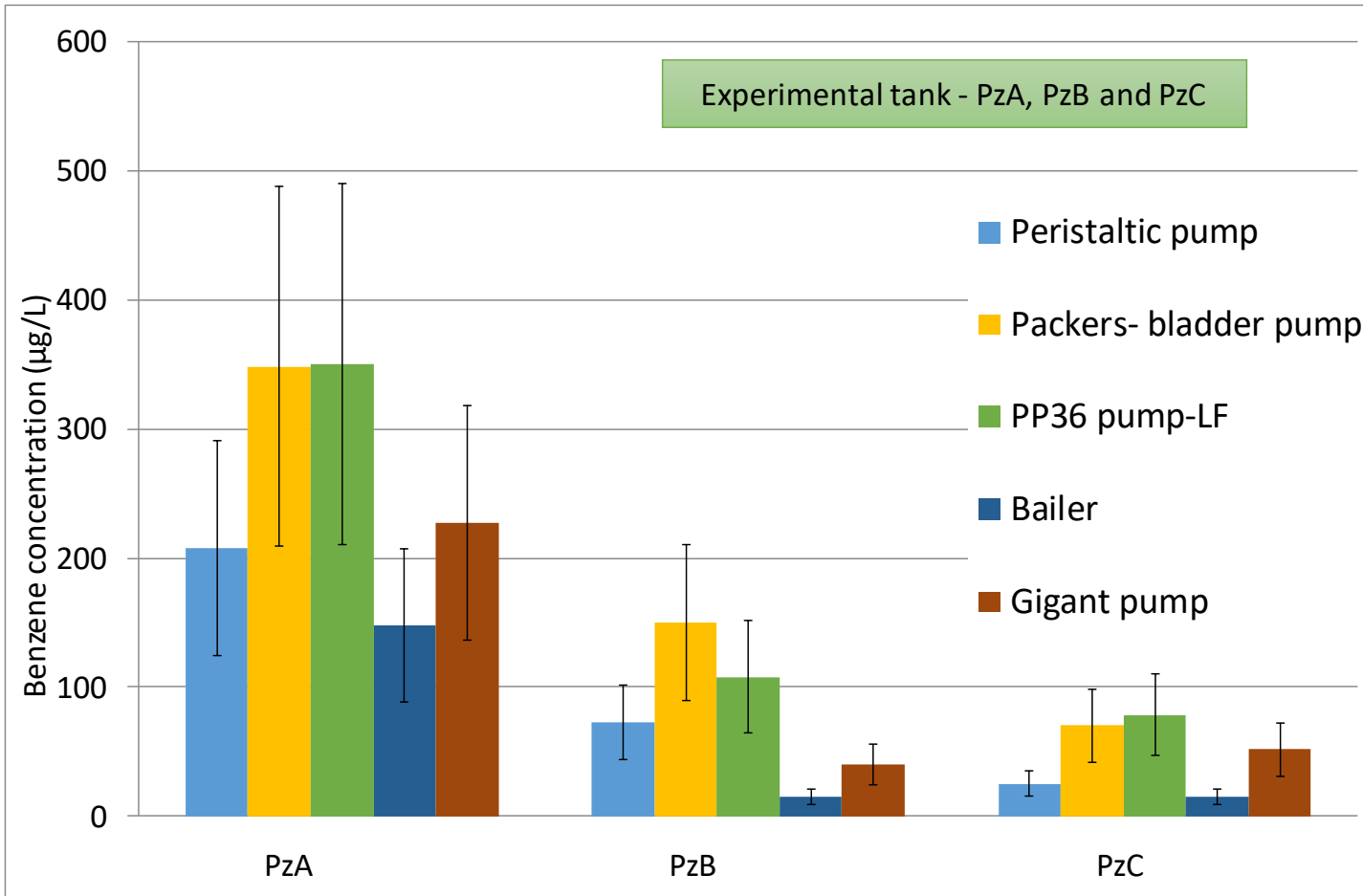

Small influence / BTEX
(considering analytical <u>uncertainty</u>)

Small influence / BTEX
(considering analytical <u>uncertainty</u>)

Confirmation of this trend for BTEX with several campaigns and on various sites (and statistical methods)

Preliminary Results – Loss of Volatile Organic Compounds (tank)

Experimental tank - PzA, PzB and PzC

Legend:
- Peristaltic pump
- Packers- bladder pump
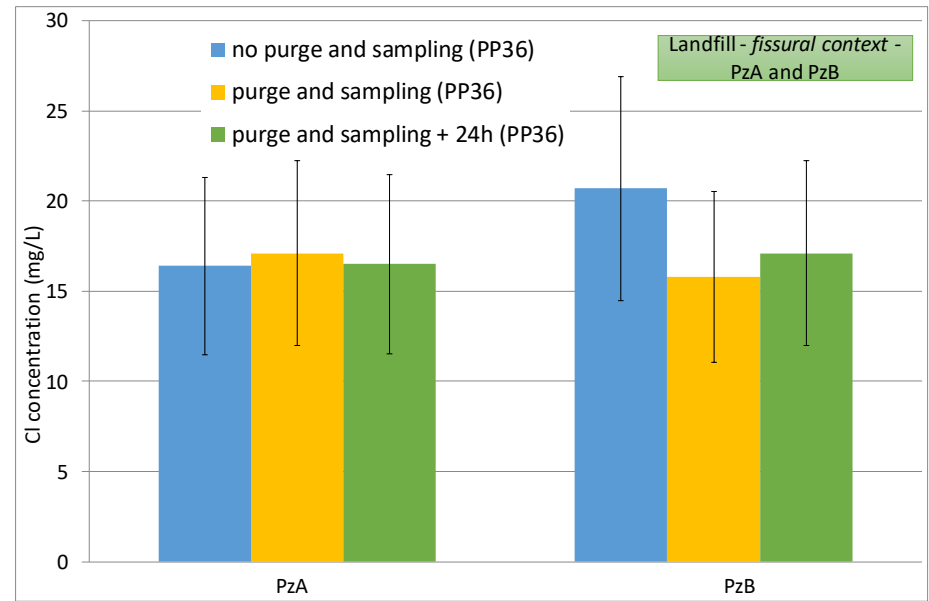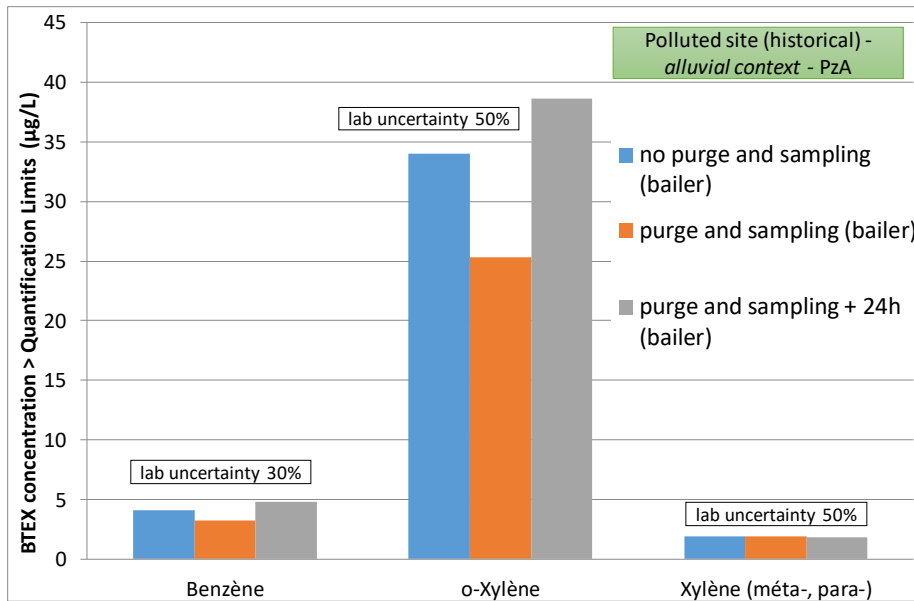- PP36 pump-LF
- Bailer
- Gigant pump

Small influence / Benzene but Low-Flow and bladder pump sampling lead to higher concentrations (considering analytical uncertainty)

Loss of volatile BTEX is small for different scale and concentration range – small influence / management
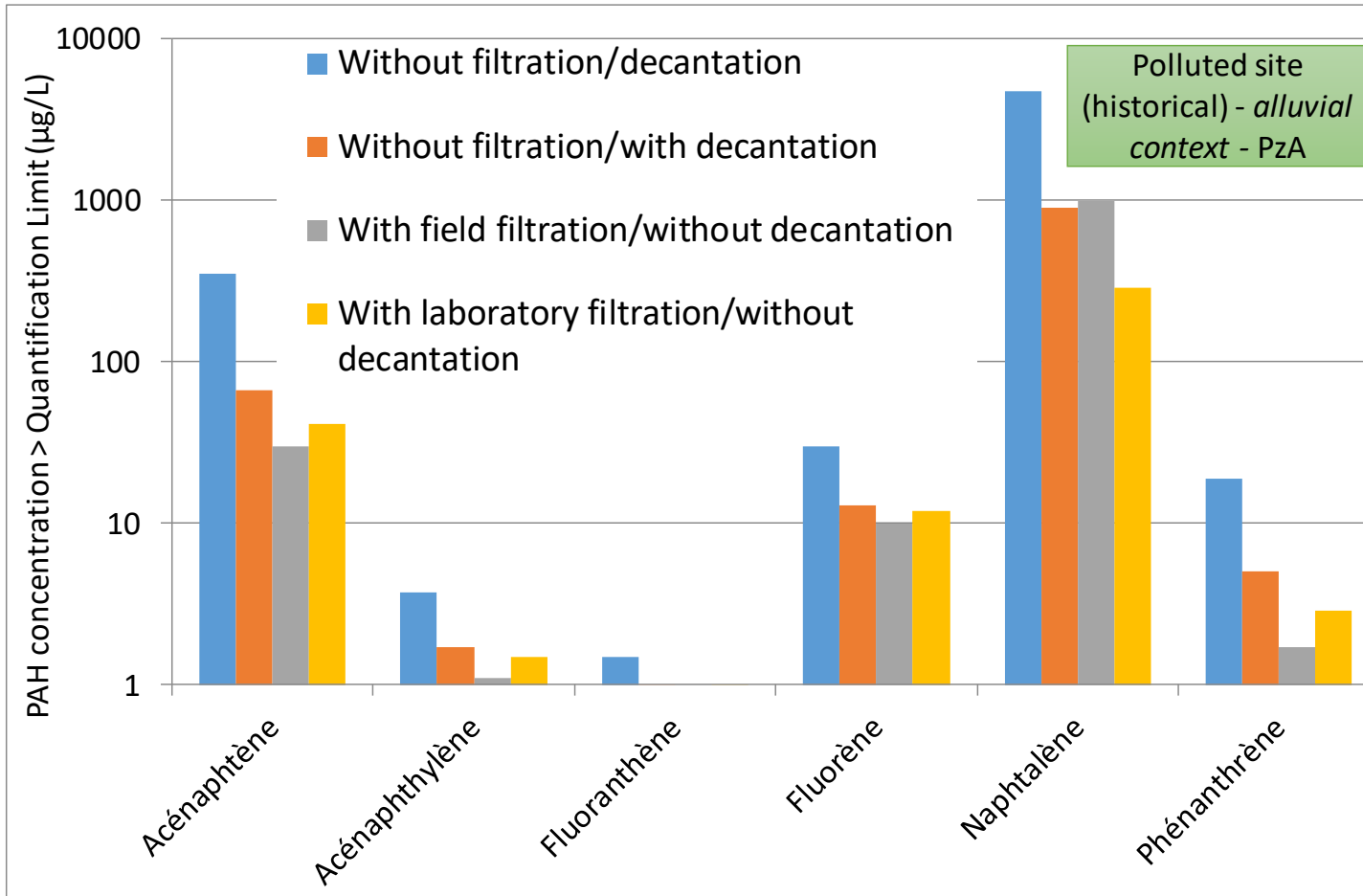
Preliminary Results – Purge influence (site)

Left chart — y-axis: BTEX concentration > Quantification Limits (µg/L); title box: Polluted site (historical) - *alluvial context* - PzA

Legend:
- no purge and sampling (bailer)
- purge and sampling (bailer)
- purge and sampling + 24h (bailer)

Categories: Benzène (lab uncertainty 30%), o-Xylène (lab uncertainty 50%), Xylène (méta-, para-) (lab uncertainty 50%)

Right chart — y-axis: Cl concentration (mg/L); title box: Landfill - *fissural context* - PzA and PzB

Legend:
- no purge and sampling (PP36)
- purge and sampling (PP36)
- purge and sampling + 24h (PP36)

Categories: PzA, PzB

Small influence / bailer & BTEX
(considering analytical <u>uncertainty</u>)

Small influence / PP36 (pump) and Cl
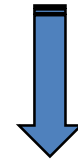(considering analytical <u>uncertainty</u>)

Influence of purge depends on site and permeability:
protocol will be adapted after tests / site
(purging is not necessary everywhere)

Preliminary Results – Sampling preparation (site)

Chart legend:
- Without filtration/decantation
- Without filtration/with decantation
- With field filtration/without decantation
- With laboratory filtration/without decantation

Polluted site (historical) - *alluvial context* - PzA

Y-axis: PAH concentration > Quantification Limit (µg/L)

X-axis categories: Acénaphtène, Acénaphthylène, Fluoranthène, Fluorène, Naphtalène, Phénanthrène
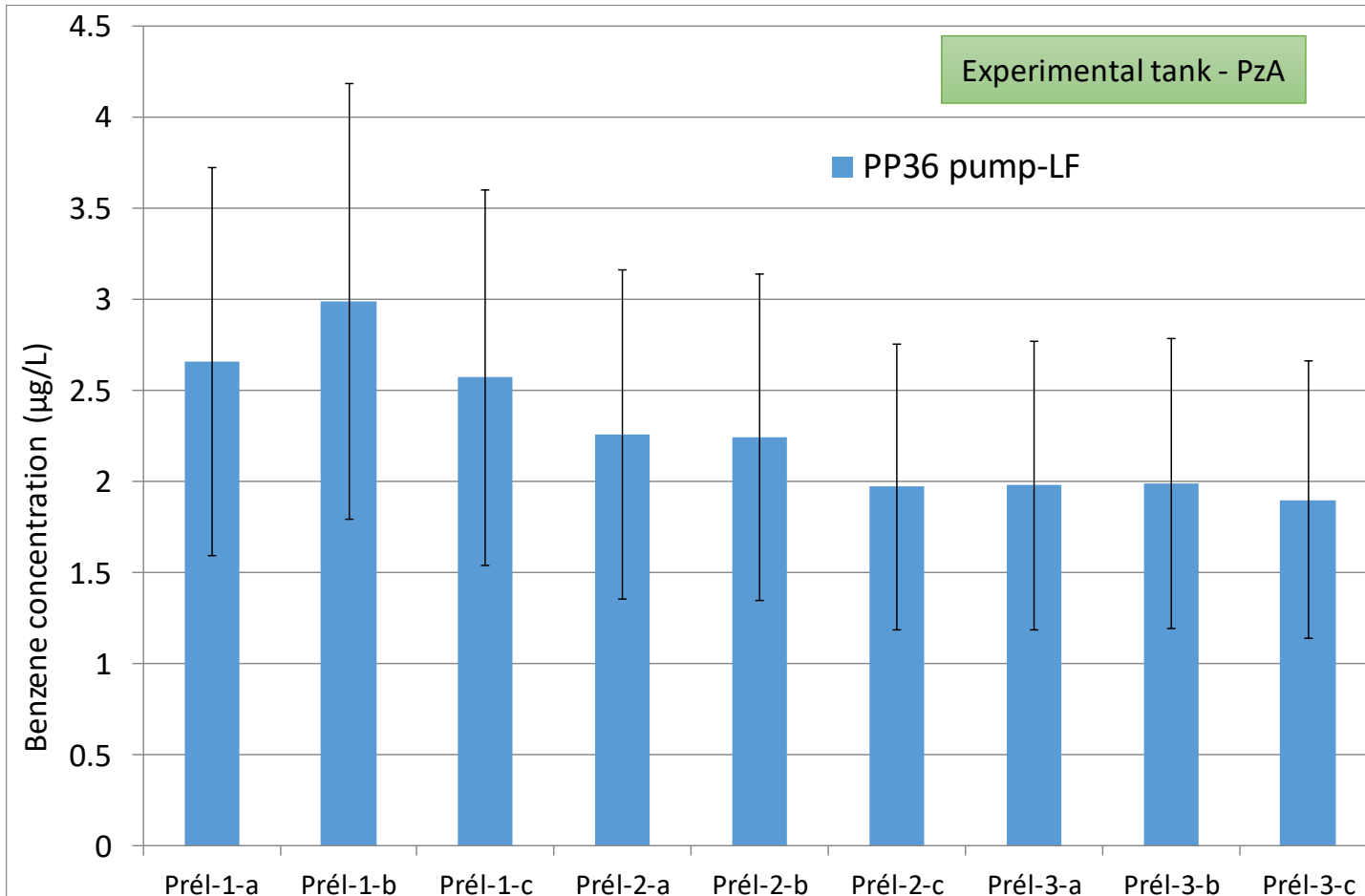
Influence of sampling preparation

Illustrate concentrations variations and the importance of knowing the preparation carried out by the laboratory

Preliminary Results – Uncertainty

Ongoing research…

- **A lot of campaigns** need to be done (objective : 4 on real sites, more in tank…)

- In some case trends are observed but not always, **statistical methods** will help us to make interpretation

- In most cases samples represent a **flow-weighted average of the well screen zone**…

Thank you!

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