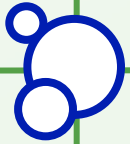


Copper, lead and nickel concentrations at consumer's tap

Investigations in hard waters with high Total Organic Carbon

**CEOCOR – Mondorf les bains
31 May 2006**





INTRODUCTION

- DWD 98/83/EC : Copper < 2 mg/L (*« Average concentration »*)
- CEOCOR Biarritz 2001 (Priggemeyer et al.)

Experimentation in 390 households / 54 water distribution areas

80 % Mean [Cu] < 2 mg/L ([Cu] after 4 hours stagnation)

[Cu] > 2 mg/L

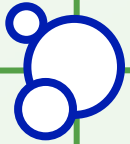
- Northeast of Germany (+ Lübbenau)



For waters with low pH (< 7,4)

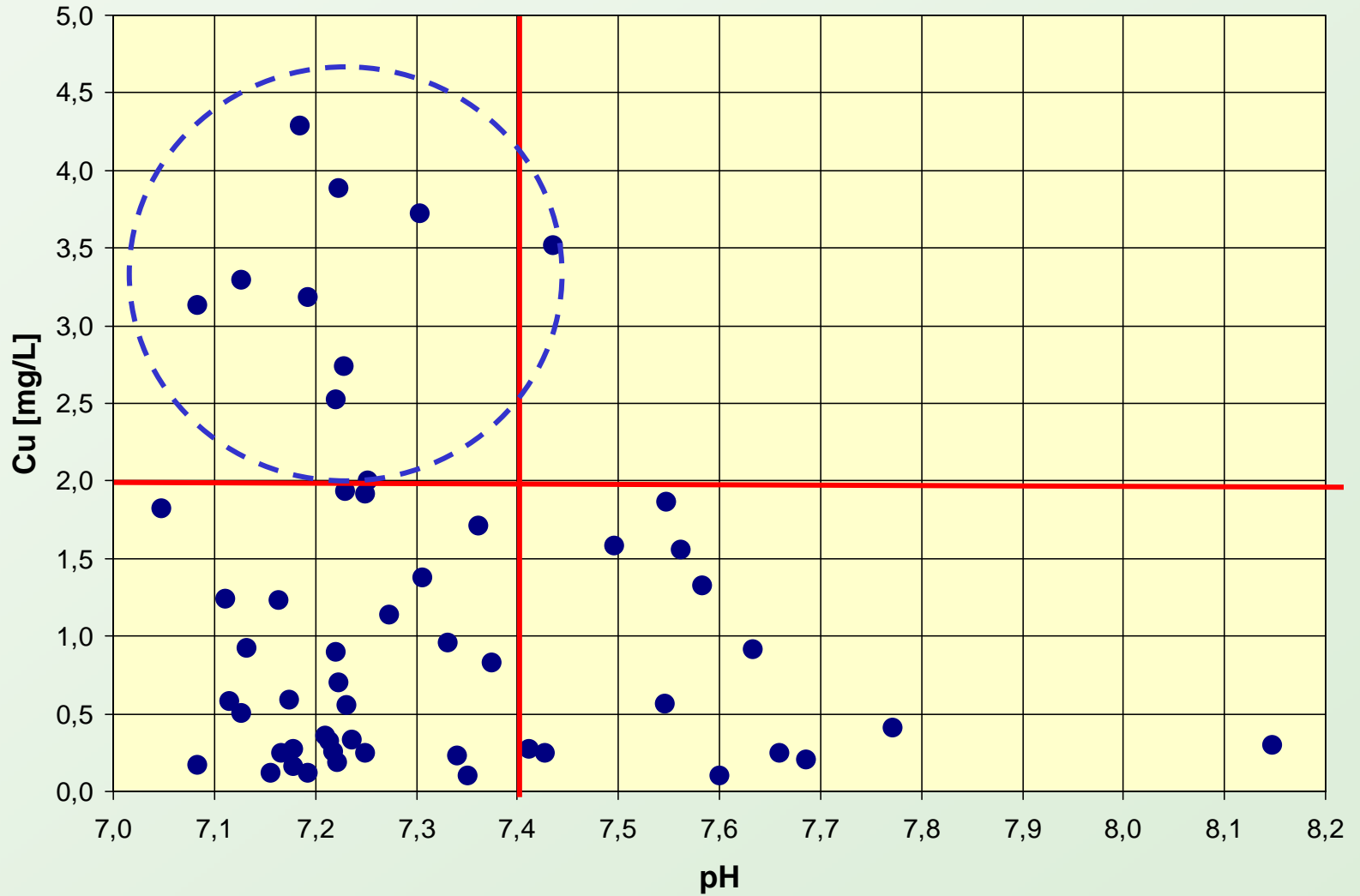
and high TOC (> 1,5 – 2 mg/L)

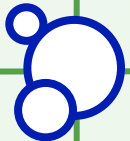




Copper after 4 hours stagnation vs pH

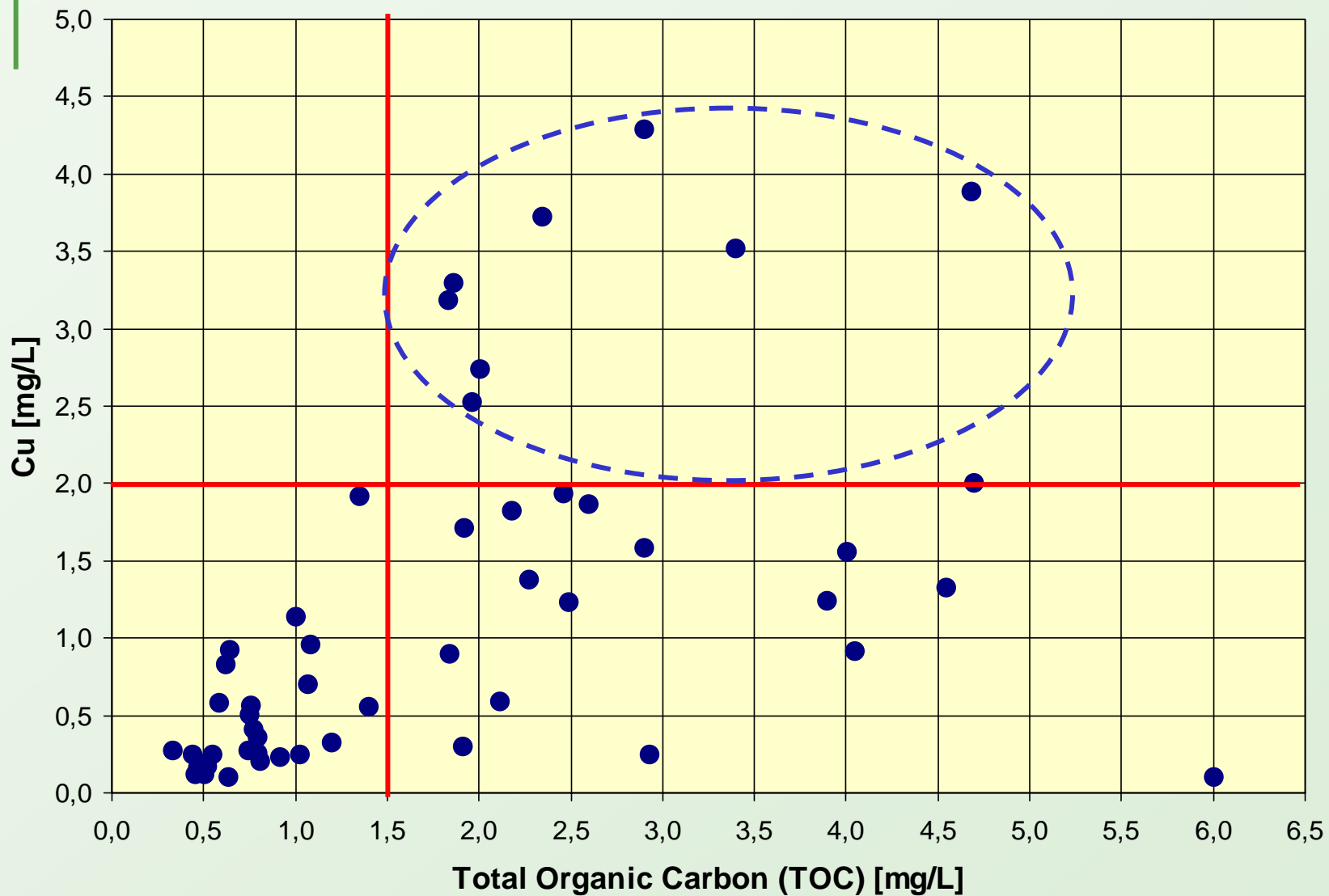
Priggemeyer et al. CEOCOR Biarritz 2001

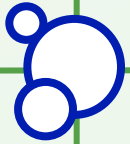




Copper after 4 hours stagnation vs TOC

Priggemeyer et al. CEOCOR Biarritz 2001





Investigations in France

Only few data available for copper at consumer's tap

1996 : Study by AGHTM in 97 households

Cu > 2 mg/L : only in very soft aggressive waters

1/97 (1%) in flow proportional sampling

6/97 (6%) in 1st draw after overnight stagnation.

= > What about hard water with high TOC ?

ASTE Working group with

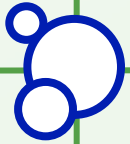
Health authorities

Water suppliers

Laboratories

Copper industry

Tap manufacturers



Investigations in France

- 1- Identification of distribution waters with
 - Total Hardness > 250 mg CaCO₃/L
 - pH < 7,4
 - TOC > 1,5 mg/L

(Heath ministry and water suppliers data bases)

=> Selection of 10 distribution units

2- TOC analysis for confirmation in selected areas

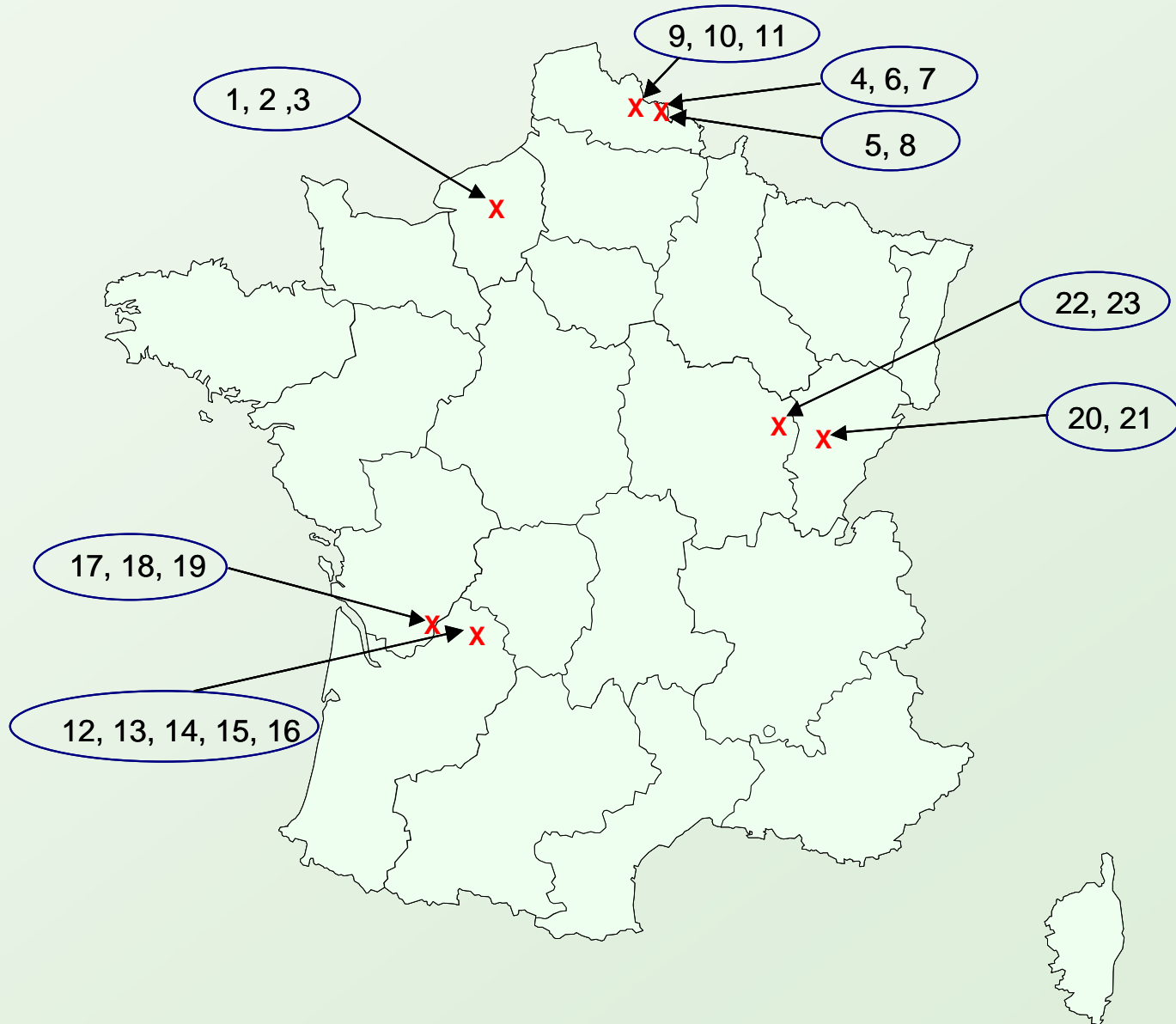
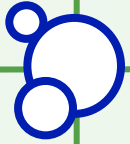
3- Identification of households for sampling

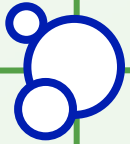
Conditions :

- > 5 m copper pipes before sampling point
- Installation > 1 year
- no additional treatment

23 households / sampling points

23 Sampling points / 8 water distribution units





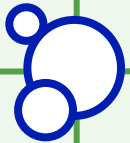
Sampling protocol

- Flow proportional sampling during 1 week
- After 30 minutes stagnation – 2 litres
- After 4 hours stagnation
 - 1st draw , 100 ml
 - next 500 ml
- After overnight stagnation
 - 1st draw , 100 ml
 - next 500 ml

2 x / Weeks

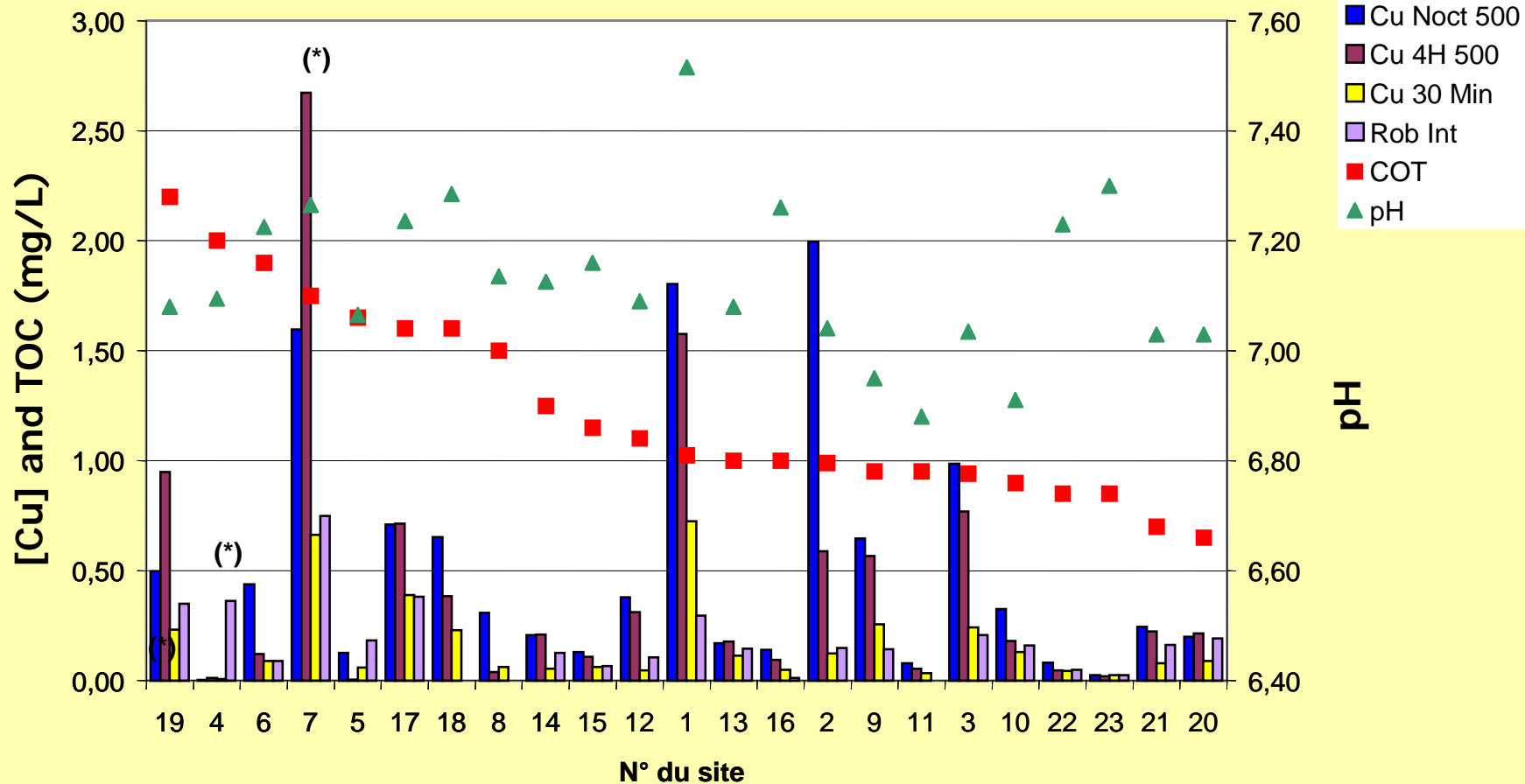
Analysis : Copper, lead and nickel

+ control of pH, Total hardness and TOC during the same week (after flushing)

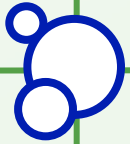


RESULTS

1 - Copper



(*) : les points de prélèvement n° 4 et n° 7 constituent des points particuliers qui ne sont pas pris en compte dans l'interprétation des résultats

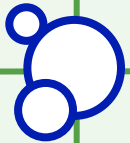


Results for copper

- Flow proportional sampling : all results [Cu] < 0,4 mg/L
- 30 min. Stagnation : all results [Cu] < 1 mg/L (max = 0,72 mg/L)
- 4 hours stagnation (500 mL) : all results [Cu] < 2 mg/L
1 result > 1 mg/L
- Overnight stagnation (500 mL) : 2 results # 2 mg/L
- 1st draw (100 ml) : all results [Cu] < 2 mg/L

⇒ **No high copper concentrations**

But : TOC concentrations are quite low

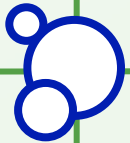


Average Copper concentrations, TOC and pH in the 8 distribution areas

Copper after 4 hours, 500 ml

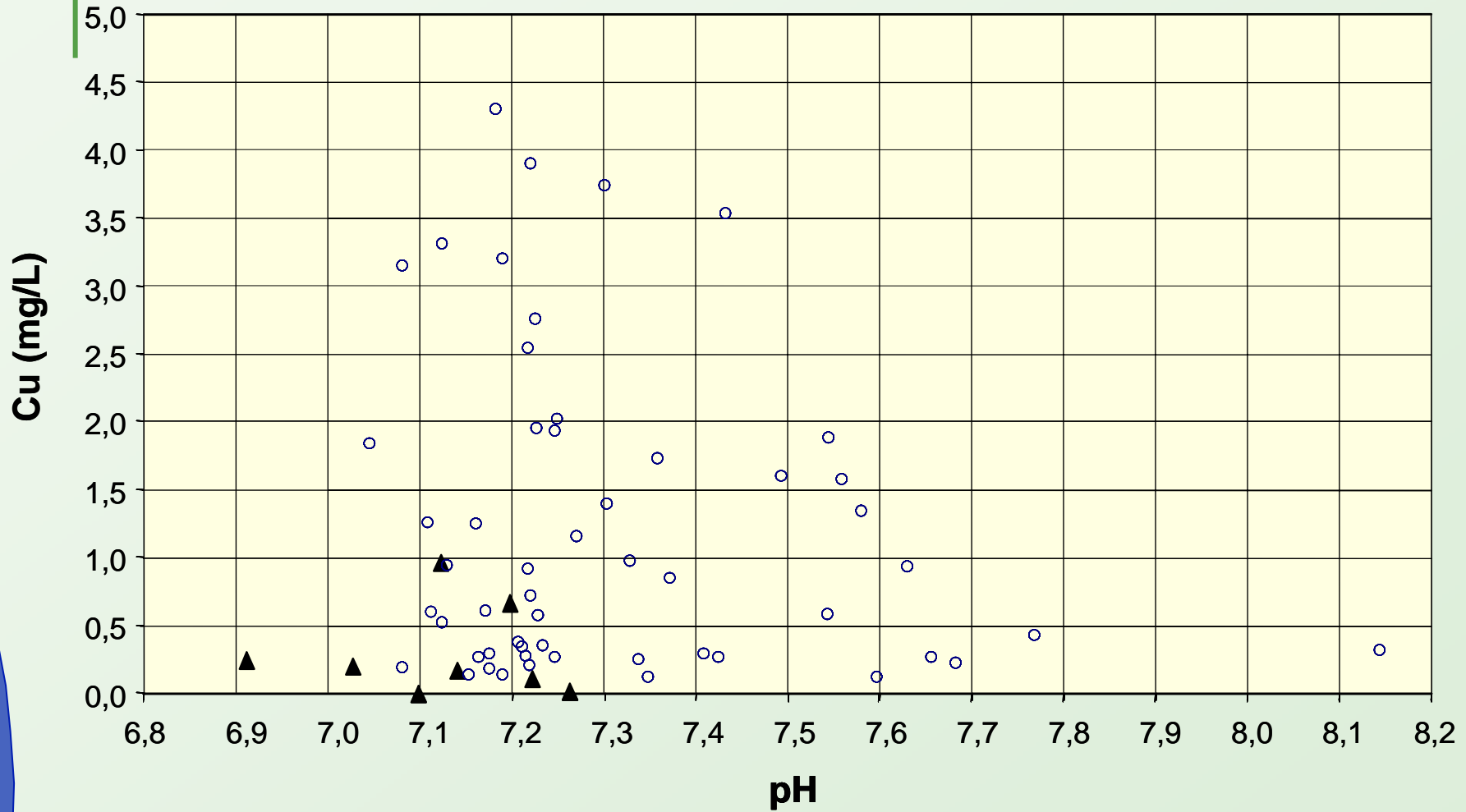
Distribution area	Point Number	TOC (mg /L)	pH	Cu * (mg/L)
1	1, 2, 3	0,99	7,12	0,98
2	6 (4 et 7 excluded)	1,90	7,23	0,12
3	5, 8	1,58	7,10	0,02
4	9, 10, 11	0,93	6,91	0,27
5	12, 13, 14, 15, 16	1,10	7,14	0,18
6	17, 18, 19	1,80	7,20	0,68
7	20,21	0,68	7,03	0,22
8	22, 23	0,85	7,27	0,03

=> Only 3 areas with measured TOC > 1,5 mg/L

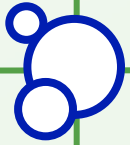


Comparison with the results of the German study (2)

2- Copper vs pH



○ Germany (Priggemeyer et al., 2001) ▲ ASTEE 2004 (moyennes par UDI)



Comparison with the results of the German study (3)

Only limited number of sampling points in French study

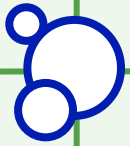
No high TOC concentrations

Range of pH and COT covered is much smaller than in German study

⇒ Only few cases of hard water with high TOC supplied

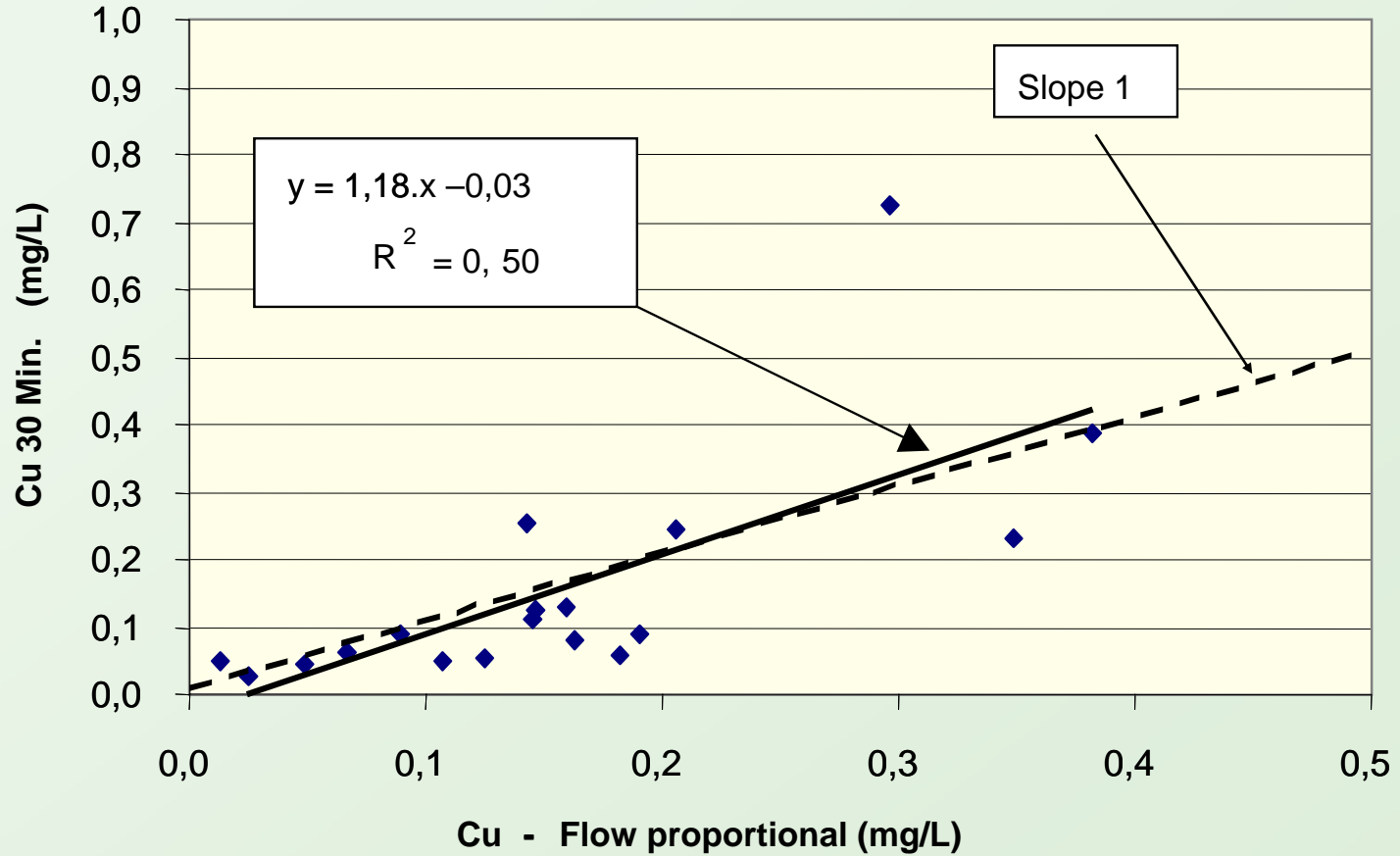
(more investigations needed to identify such waters)

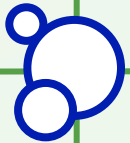
⇒ *NO « copper problem » detected*



Comparison of sampling protocols (1)

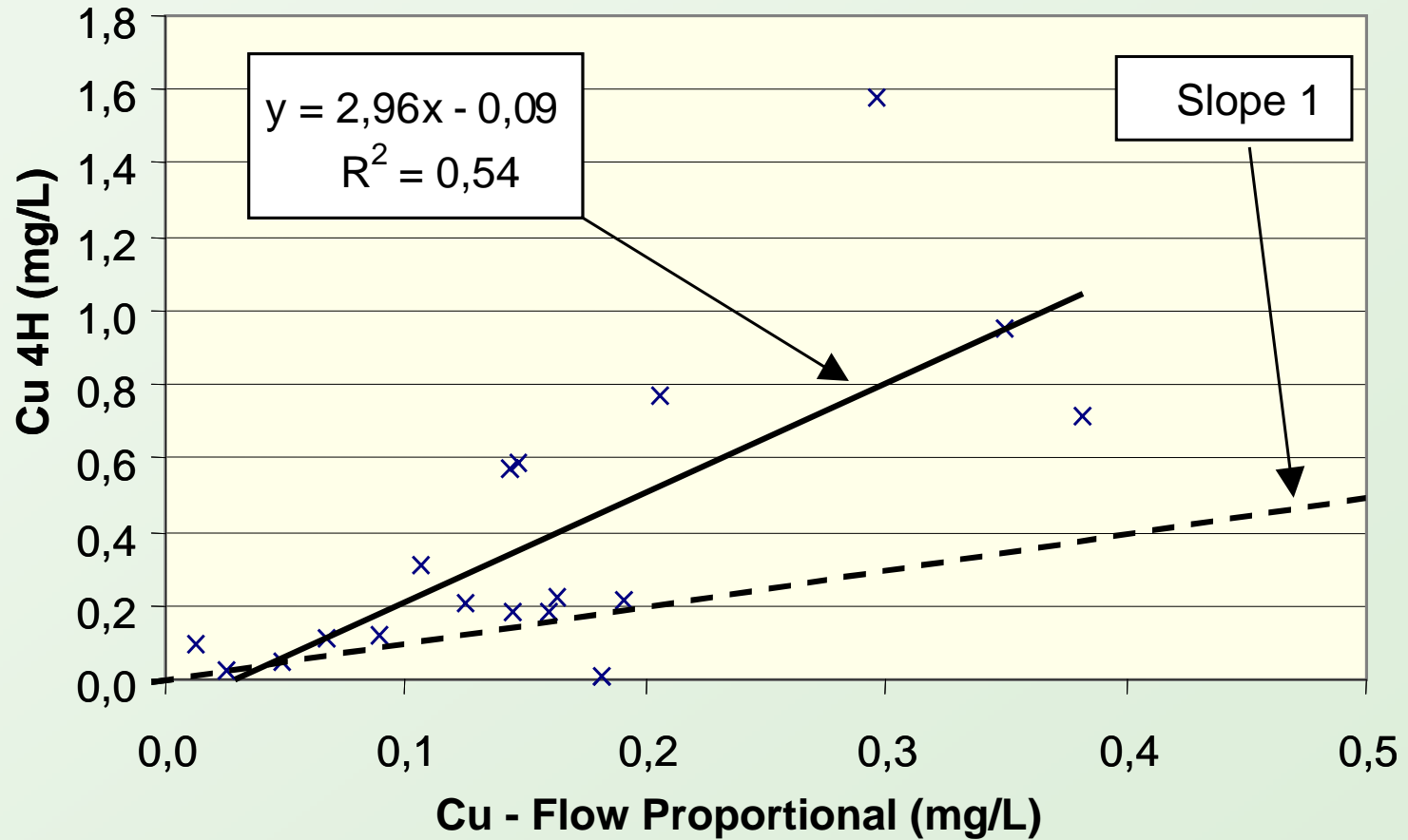
1- Cu 30 min. vs Cu in Flow proportional samples

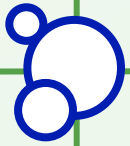




Comparison of sampling protocols (2)

2- Cu 4 hours vs Cu in Flow proportional samples





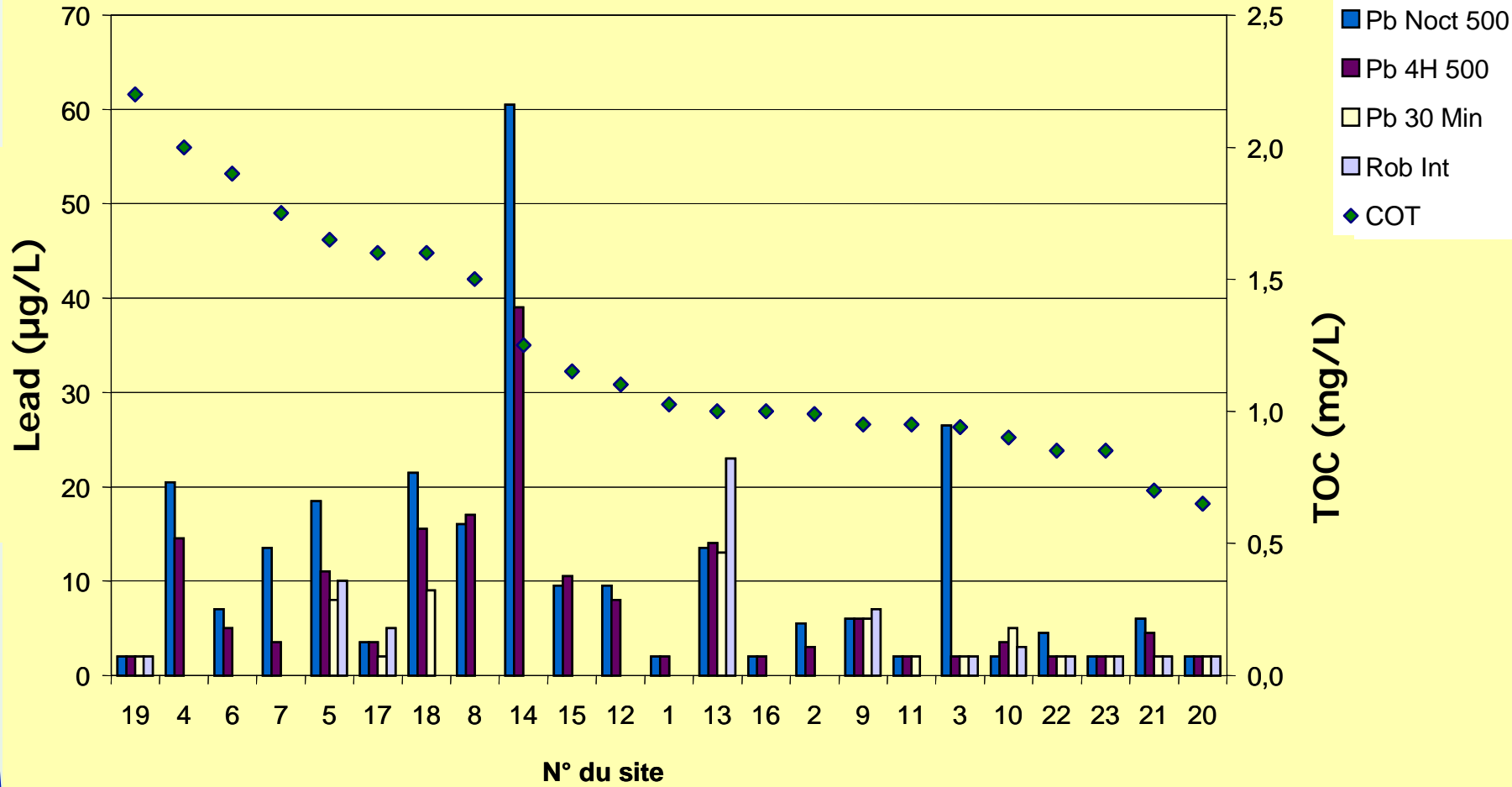
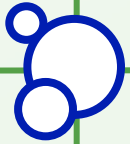
Comparison of sampling protocols (3)

No significant correlation between
flow PROPortional samples (« average concentration »)
and 4 hours or 30 min. samples

30 minutes / PROP : slope # 1 -

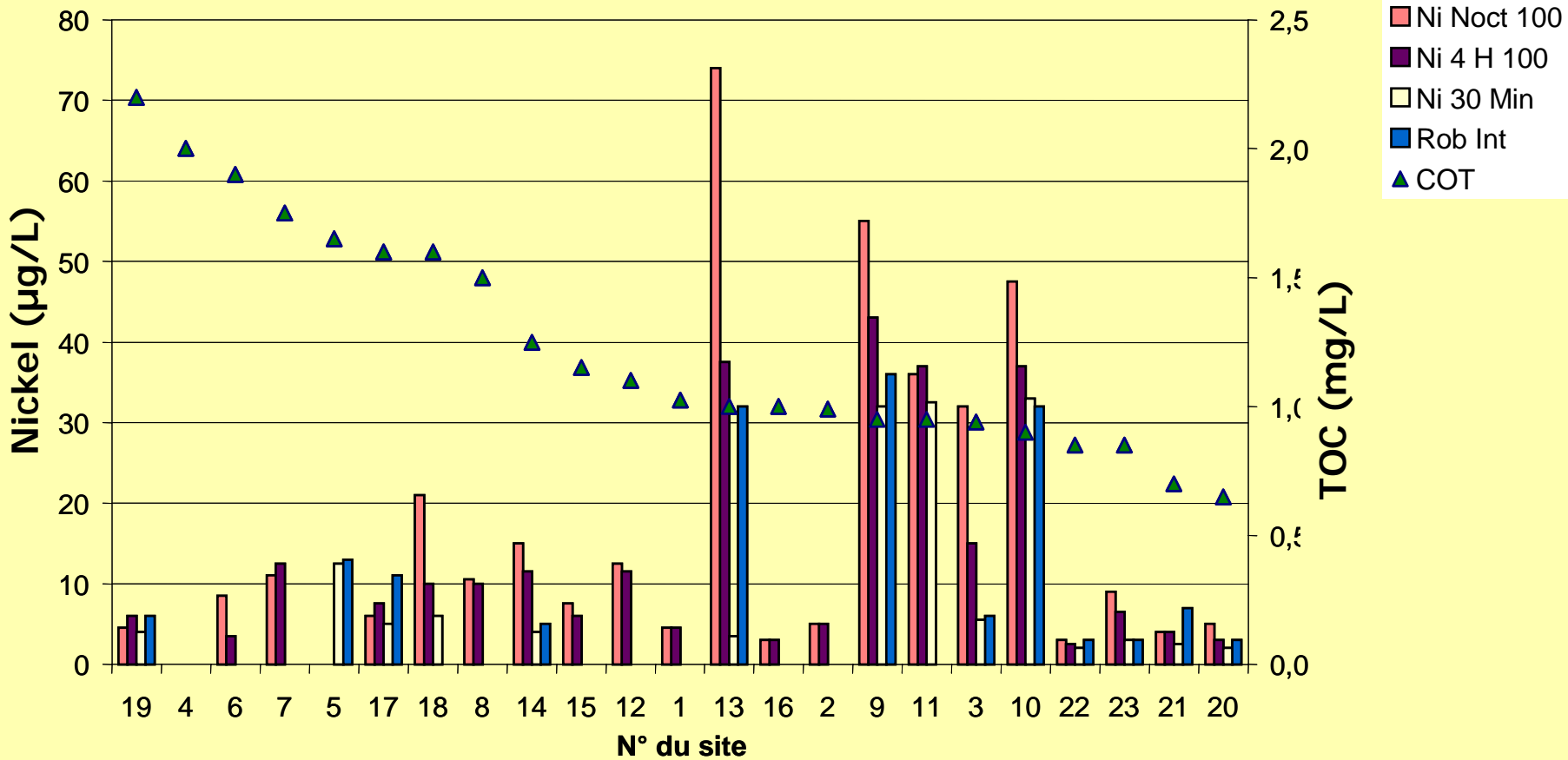
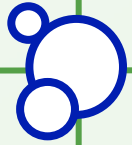
4 hours / PROP : slope $\gg 1$ – Overestimate average copper concentrations

RESULTS FOR LEAD

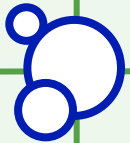


No contribution from taps detected

RESULTS FOR NICKEL (1)



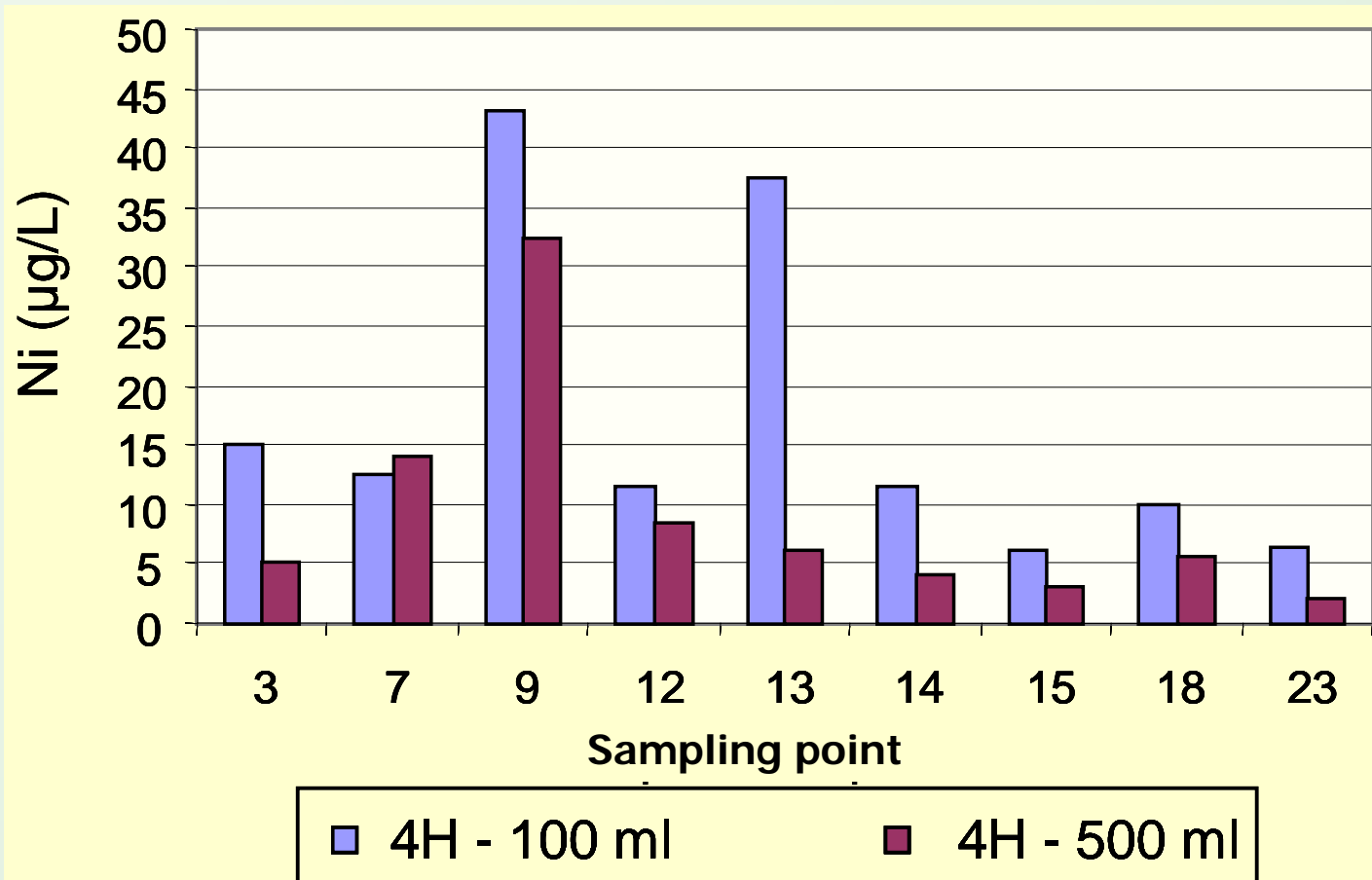
Points n° 9, 10 and 11 : > 30 µg Ni/L in water supply



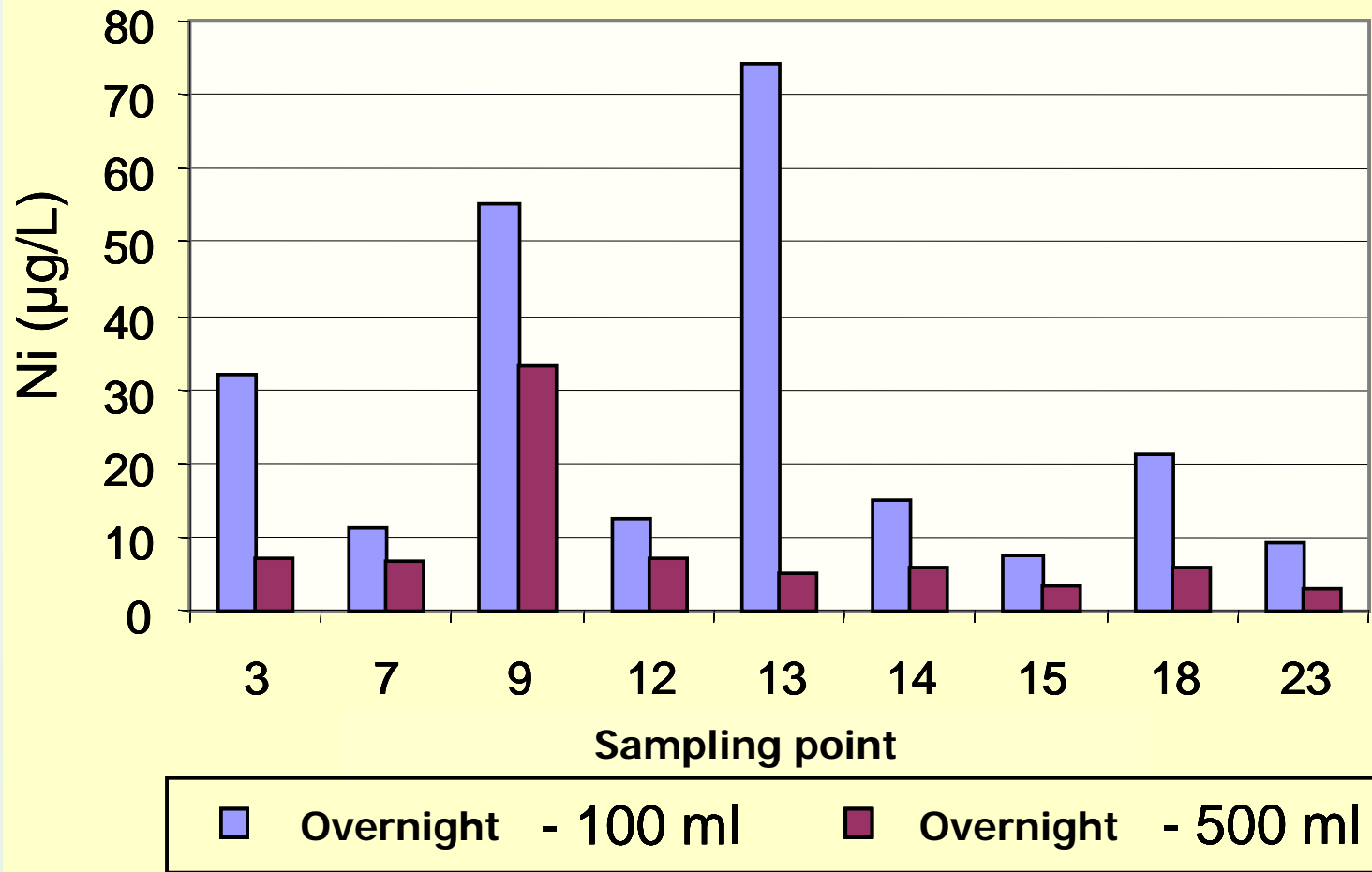
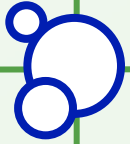
RESULTS FOR NICKEL (2)

Leaching from taps : can be suspected for 9 points

Comparison 1st draw (100 ml) sample / following 500 ml samples

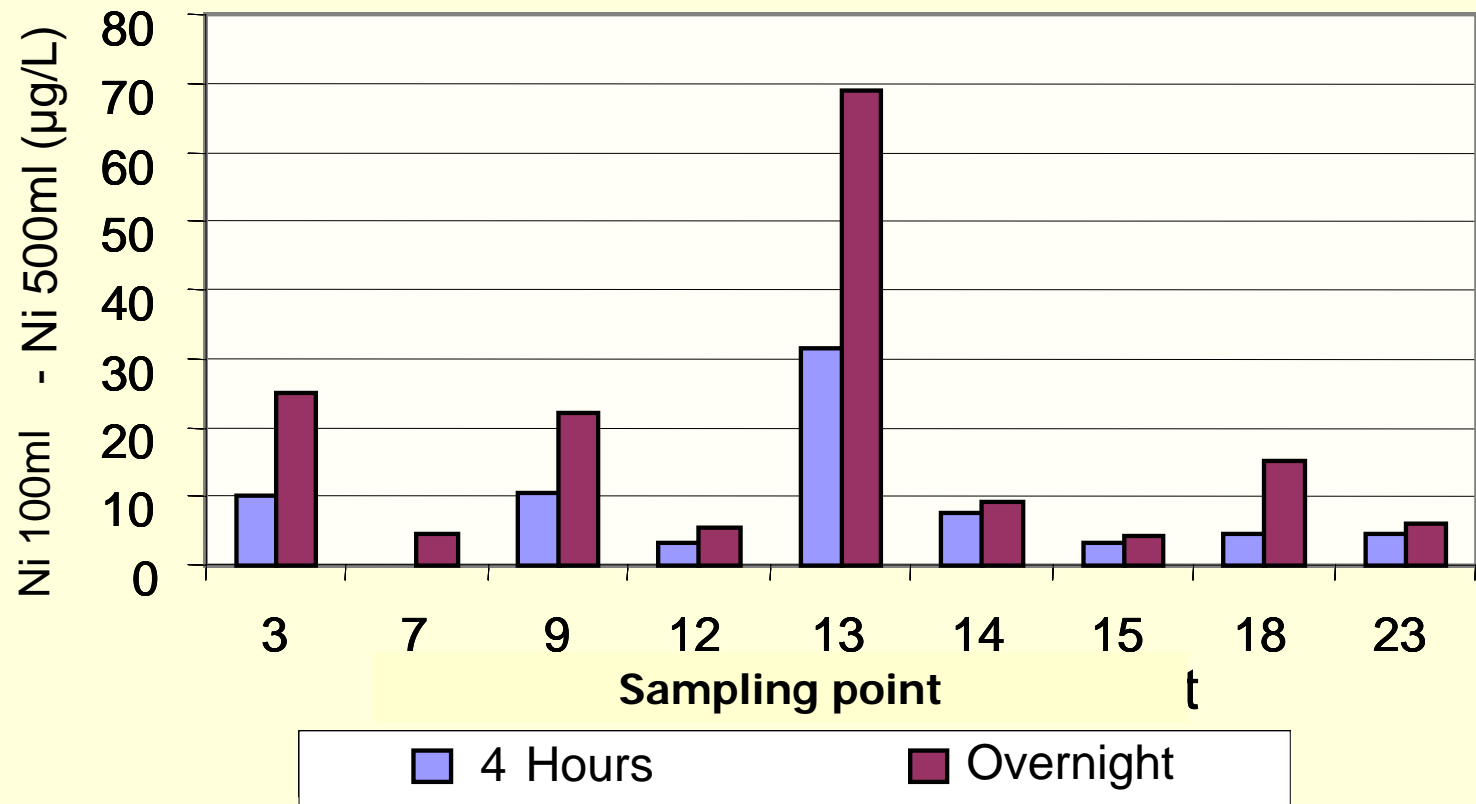


RESULTS FOR NICKEL (3)



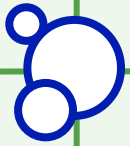
RESULTS FOR NICKEL (4)

Nickel from tap (first 100 ml – next 500 ml)



⇒ Contribution from tap, < 10 µg/L in most cases

⇒ No relation found with the age or type of tap



CONCLUSIONS

1 – Copper :

Only few water with high alkalinity, low pH and high TOC

=> Impact of TOC on copper dissolution can not be observed

No major problem with copper in selected areas

2 – Lead :

No contribution from taps identified

2 – Nickel :

Some contribution from taps for 9 of the 23 points tested

< 10 µg/L in most cases after (8/9) after 4 hours stagnation