



## 63<sup>rd</sup> EAAP meeting

Slovak Technical University, Bratislava, Slovakia, August 27-31, 2012

S.39 Management and health: business meeting and free communications

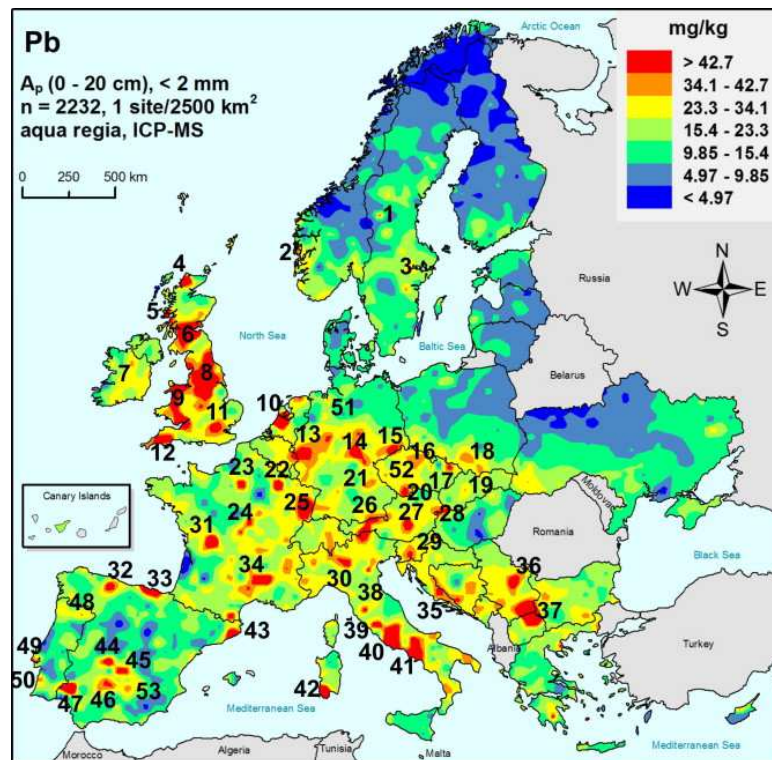
# Transfer of trace elements from feed to pig tissues: management of feed and food limits

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Ifip-institut du porc, France



# Trace elements in agricultural soils

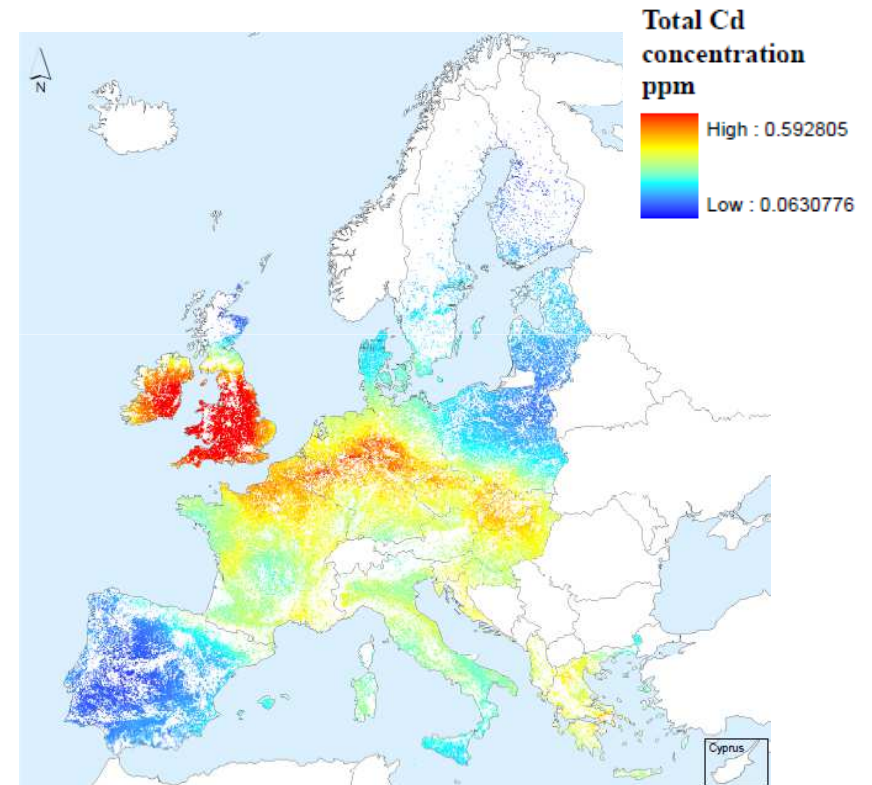
## Pb concentration



Clemens Reimann et al,  
 Applied Geochemistry, 27, 3, 2012

EAAP meeting, August 27-31, 2012, Bratislava

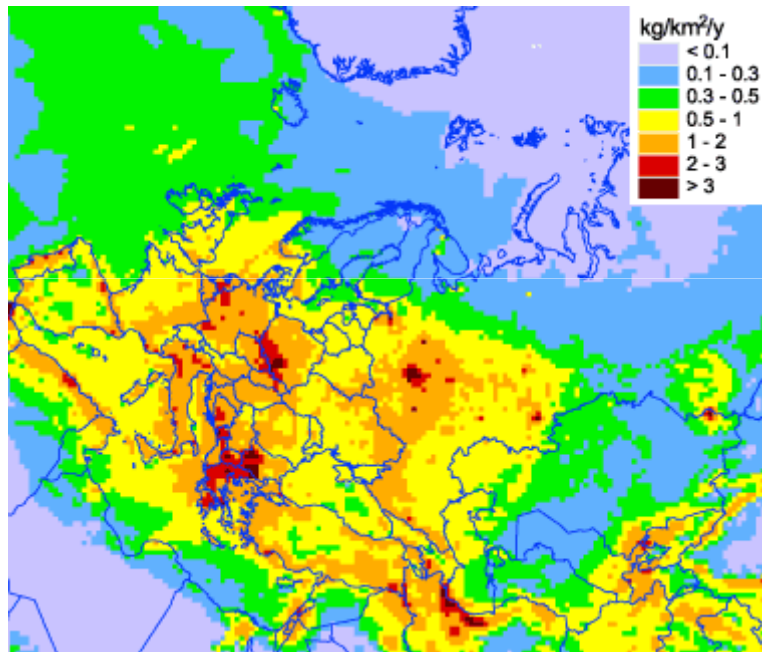
## Cd concentration



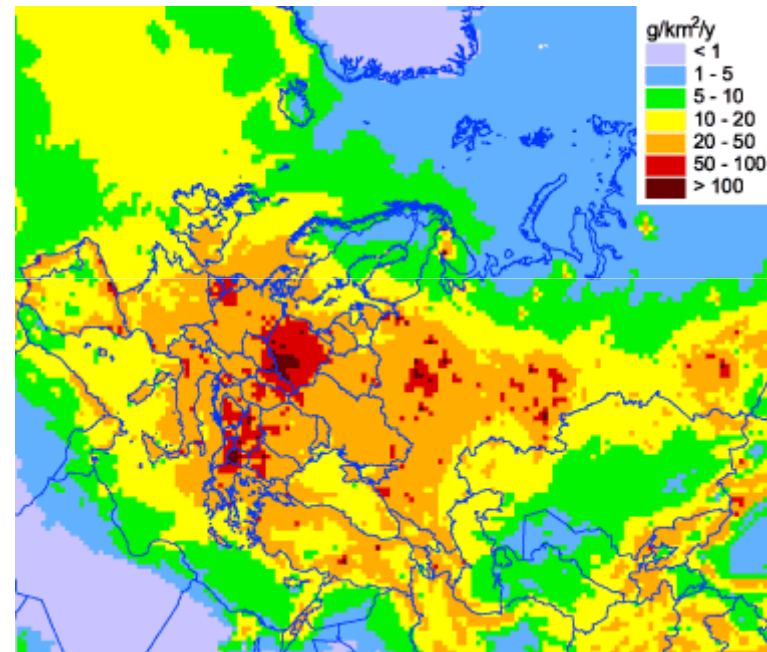
Report on the project 'Sustainable Agriculture and Soil Conservation (SoCo)'  
[http://eusoils.jrc.ec.europa.eu/ESDB\\_Archive/eusoils\\_docs/other/EUR23767\\_Final.pdf](http://eusoils.jrc.ec.europa.eu/ESDB_Archive/eusoils_docs/other/EUR23767_Final.pdf)

# Total (dry and wet) deposition of Pb and Cd in 2009

## Pb deposition



## Cd deposition

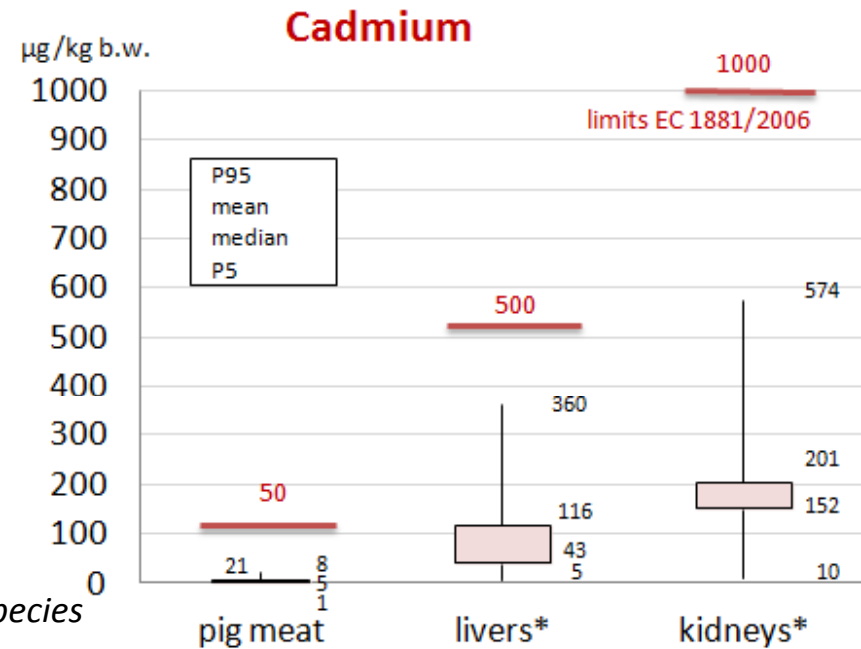
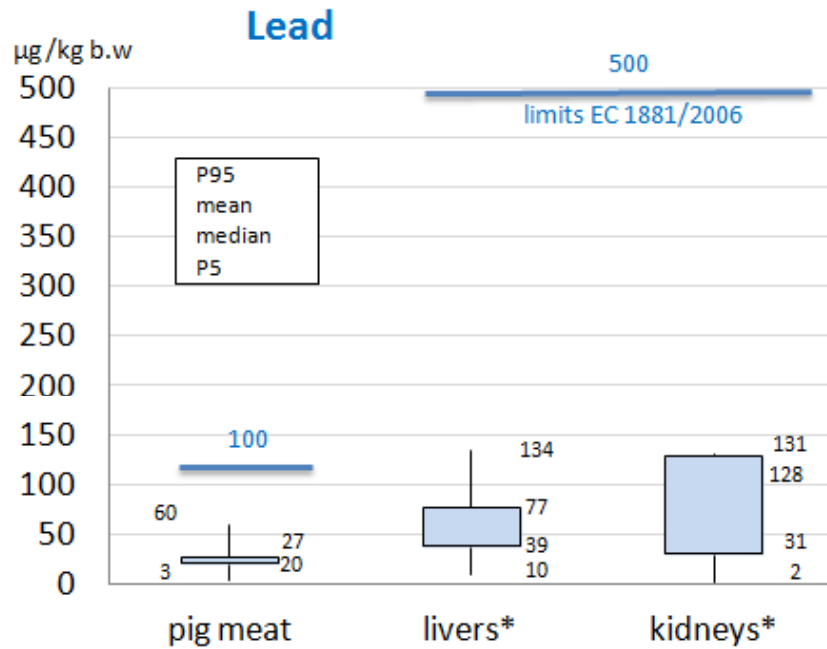


EMEP data (Co-operative programme for monitoring and evaluation of the long-range transmissions of air pollutants in Europe)  
[http://www.msceast.org/index.php?option=com\\_content&view=article&id=88&Itemid=29](http://www.msceast.org/index.php?option=com_content&view=article&id=88&Itemid=29)

# Pb and Cd occurrence in EU



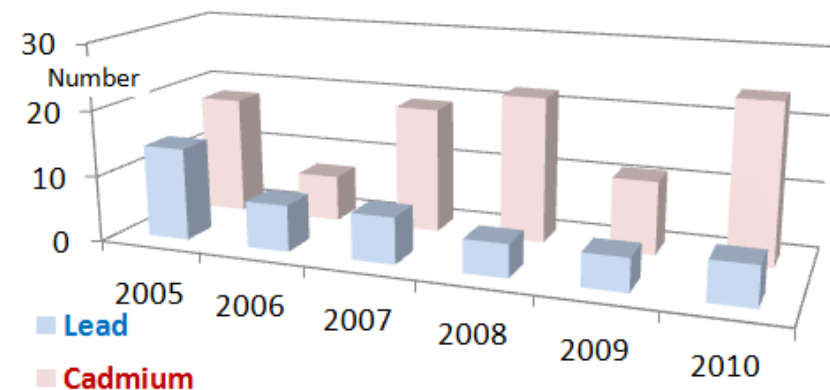
## ■ pig meat and edible offals (from Efsa, 2009, 2010)



\*all species

## ■ non-compliant samples in pigs

from EC, 4000 to 5000 targeted samples per year



# Background and aims of the study



## ■ regulations

- different methods to calculate maximal levels in feed- and foodstuffs
  - animal feeding (Directive 2002/32 of Parliament & Council)
  - food (Regulation 1881/2006 of Commission)

## ■ few studies with low exposure levels

- toxicological studies : levels  $\geq$  tolerance levels
- interactions with protein, Cu,... Contents

## ■ experimental study in pigs

- low dietary doses Cd & Pb  $\rightarrow$  food products

# Experimental design



- **long term dietary exposure to Cd / Pb**

- post weaning to slaughtering (119 days)
- standard diets and rearing conditions

- **exp.1**

- control vs **< 0.5 mg Cd /kg**, **< 5 mg Pb /kg** (maximal limits in complete feeds for pigs)

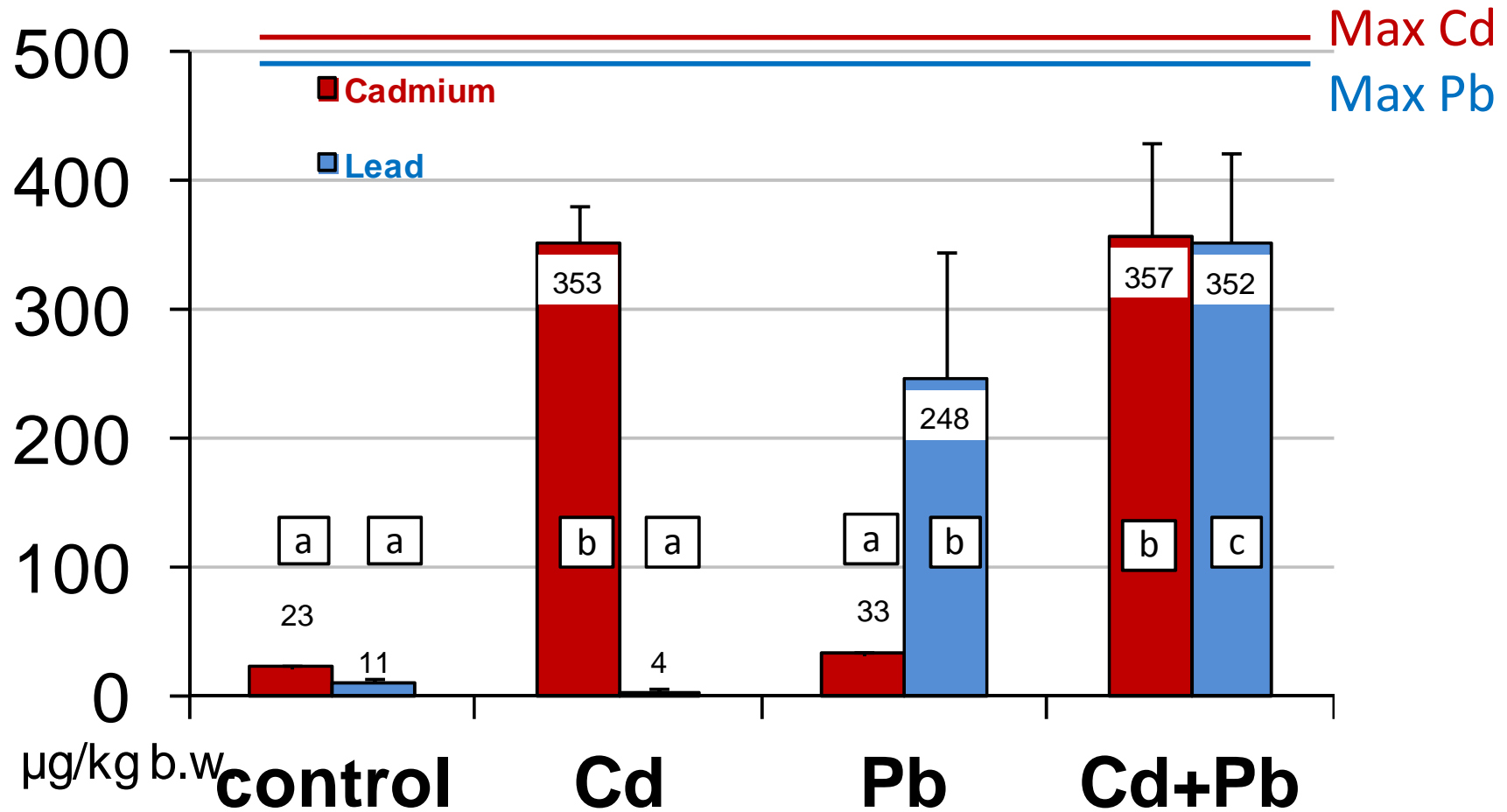
	control	Cd	Pb	Cd+Pb
Cd	-	+	-	+
Pb	-	-	+	+

- **exp.2**

- control vs **< 0.5 mg Cd /kg**

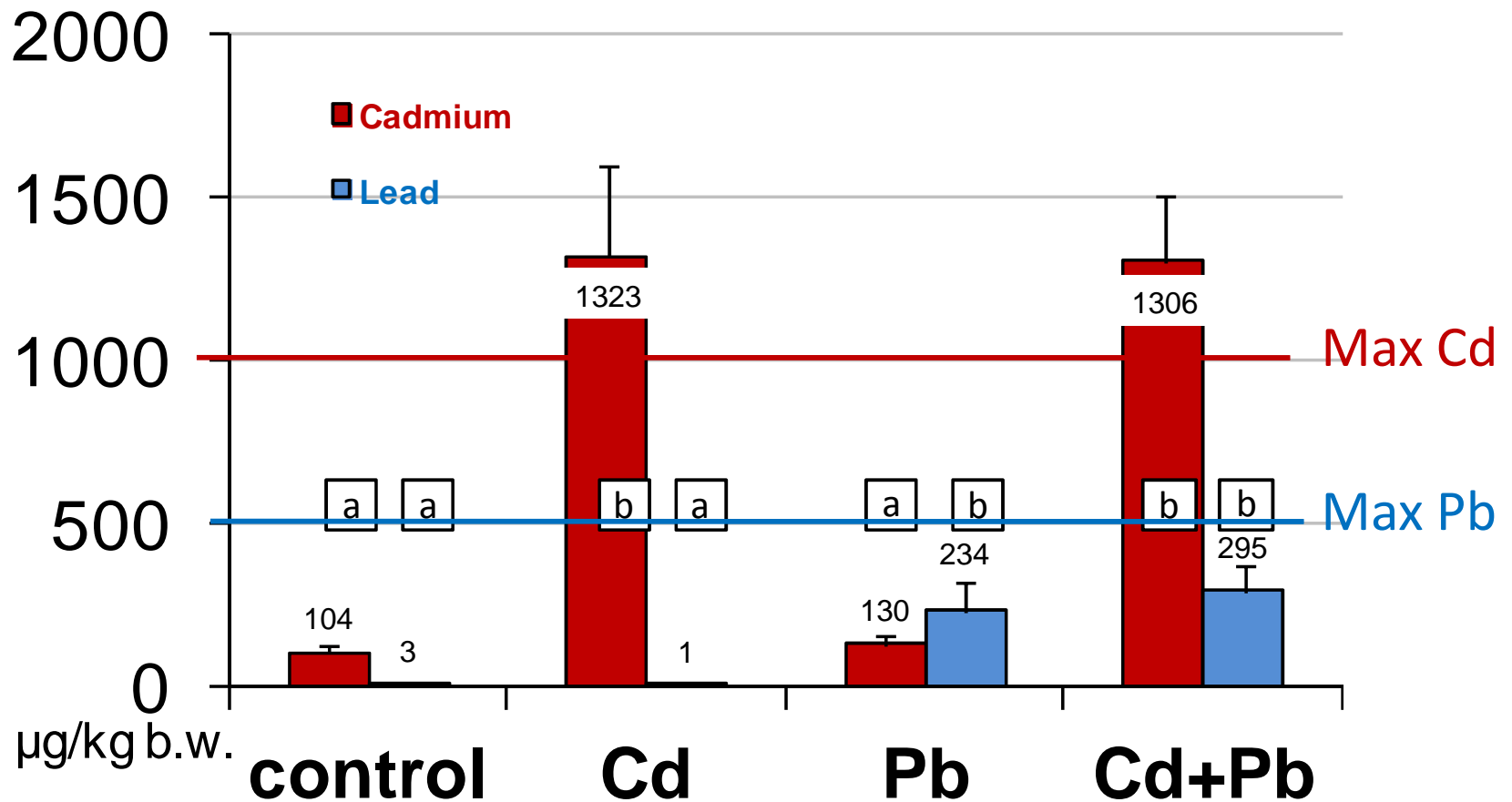
	control	Cdmin	Cdveg	Cdstop
Cd	-	+	+	+/-

# Results Exp.1 : concentrations in liver



Royer et Lebas, 2010

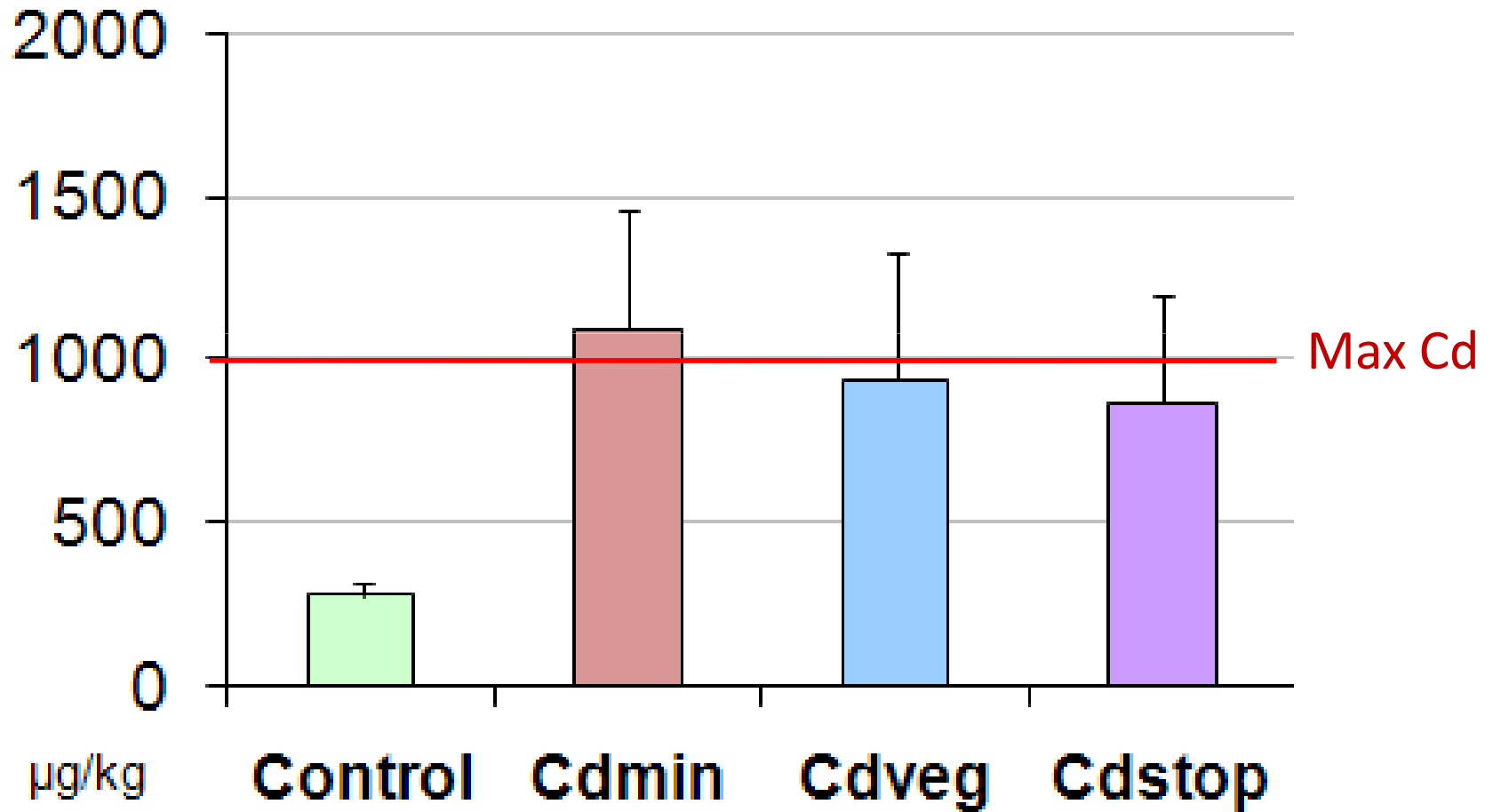
## Results Exp.1 : levels in kidneys



Royer et Lebas, 2010



## Results Exp.2 : concentrations in kidney



Royer et Lebas, 2010

# Results : concentrations in *semimembranosus* muscle

## ■ Exp. 1

µg / kg total product	control	Cd	Pb	Cd+Pb
Cadmium	< 5	< 5	< 5	< 5
Lead	< 1	-	< 1	< 1

## ■ Exp. 2

µg / kg total product	control	Cdmin	Cdveg	Cdstop
Cadmium	< 1	< 1	< 1	< 1

– Regulatory limits

- Pb = 100 µg/kg total product
- Cd = 50 µg/kg total product

# Implications

## ■ long term & low level exposure of pigs

### ■ exposed pigs

- low levels in meat
- no excess for Pb and liver (Cd)
- but ...slight excess for Cd level in kidney

### ■ [livers & kidneys] = f(feeds)

- [Pb] > Phillips et al, 2003
- Rambeck et al, 1991 > [Cd] ≅ Rothe et al, 1994, Linden, 2002 > Phillips et al, 2003

## ■ management of feed and food limits

### ■ ...compliance to a feed limit does not mean that animal products are not above the food limits....

- ALARA vs. Tolerable Weekly Intake approaches
- Modeling Cd accumulation in sheep , eggs, milk ..[Prankel et al, 2005, van Eijkeren et al, 2006; van Raamsdonk et al, 2009]

# new fact: more need to reduce Cd exposure !

## ■ Tolerable Weekly Intake

- Joint FAO/WHO Expert Committee on Food Additives (JECFA):
  - ◆ 1988: 7 µg/kg body weight
  - ◆ 2010: 5.8 µg/kg body weight
- EFSA Panel on Contaminants in the Food Chain:
  - ◆ 2009-2011: 2.5 µg/kg body weight
  - ◆ *“ensure a high level of protection of all consumers, including exposed and vulnerable subgroups of the population”*

## ■ Average Cd dietary exposure for the European population:

- EFSA Scientific report
  - ◆ 2012: 2.04 µg/kg body weight per week.

# EU Commission's review of Cd maximum levels

## ■ Questions

- which possibilities to reduce Cd exposure of general population and specific vulnerable groups (children, vegetarians)?
- room for reduction of maximum levels for foodstuffs that contribute mostly to exposure (e.g. cereals and cereal products, vegetables nuts and pulses group, **edible offals**, starchy roots and potatoes?)
- need to set new maximum levels for food commodities? If so, for which?

## ■ Working document...

- ◆ Proposal at inter-services scrutiny (other DG) in 2012
- ◆ Some concerns from different Member States...
- ◆ First discussions of Standing Committee about cocoa/chocolate, oilseeds, potatoes, wheat, milk, ...



THE EUROPEAN COMMISSION

		<b>Maximum levels (mg/kg wet weight)</b>	
3.2	<b>Cadmium</b>		
3.2.1	<b>Raw milk<sup>(6)</sup>, heat-treated milk and milk for the manufacture of milk-based products</b>	<b>0,005</b>	<b>To be discussed whether this ML is needed. Important exposure for children, but low levels.</b>
3.2.2	Meat (excluding offal) of bovine animals, sheep, pig and poultry <sup>(6)</sup>	0,050	No change
3.2.3	Horsemeat, excluding offal <sup>(6)</sup>	0,20	No change
3.2.4	Liver of bovine animals, sheep, pig, poultry and horse <sup>(6)</sup>	<b>0,30</b>	Significant exposure according to new data, reduction possible on basis of occurrence data.
3.2.5	Kidney of bovine animals, sheep, pig, poultry and horse <sup>(6)</sup>	<b>0,80</b>	Significant exposure according to new data, reduction possible on basis of occurrence data.

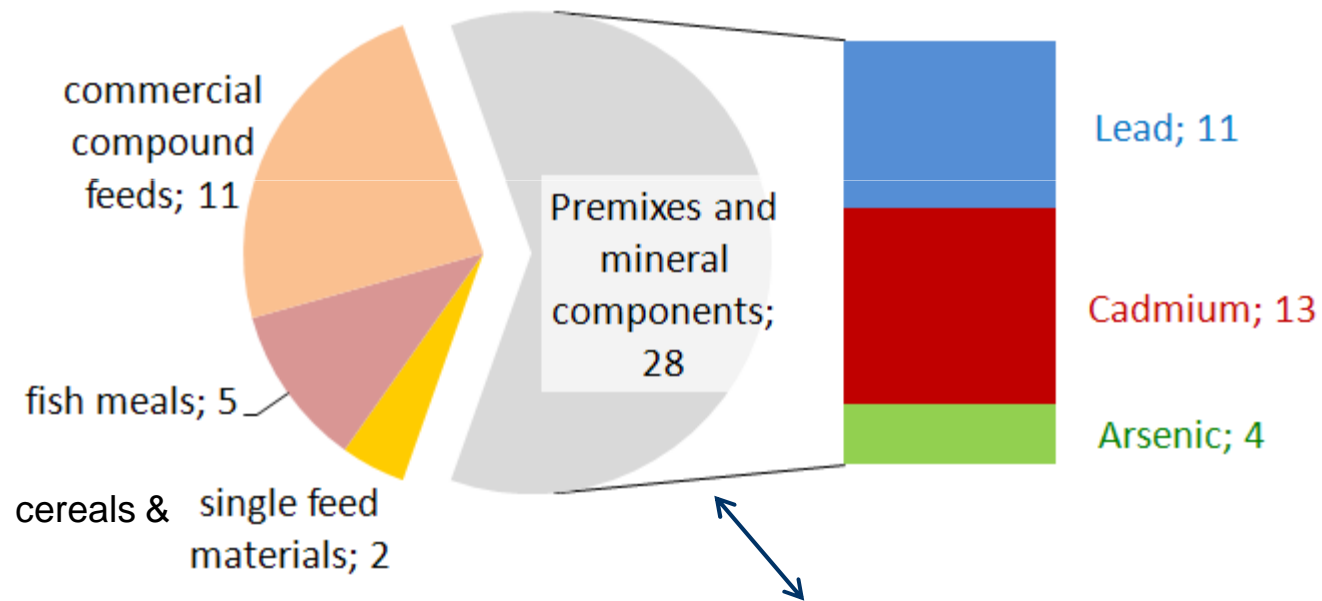
# Cd exposure of pigs: what can we do ?



- Dietary exposure period
  - accumulation pattern
    - ◆ poor effect of contaminated diet removal (Exp.2)
    - ◆ equivalence of mineral and crop origin of Cd (Exp.2)
    - ◆ effect of animal age ?
  
- Diets composition and bioavailability
  - role of diet composition
    - ◆ copper, phytase enzyme, vitamin C (Exp.3 in progress)
  
- Feed ingredients safety
  - raw materials, **minerals**

# Origin of metal contamination in animal feeds

- 45 notifications to the Rapid Alert System for Feed and Food (RASFF – 2000-2009)



Origin:

- EU : 11
- Third countries : 17



# Conclusions



## ■ Feed and food safety issues

- respecting feed limits does not imply compliance of food limits
- continuous exposure < max levels in diets → [Cd]<sub>kidney</sub> > tolerances
- role of feeding practices
- information of feed manufacturers about origin of mineral feedstuffs
- pork products
  - monitoring of offal's
  - monitoring → information of industry....

## Acknowledgments

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**Thank you for your attention**